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SLEEP-WAKE CHARACTERISTICS OF CHILDREN WITH PERVASIVE DEVELOPMENTAL DISORDERS (PDD): A SURVEY STUDY

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A higher prevalence of sleep problems and a few specific sleep-wake characteristics have been preliminarily found to be associated with pervasive developmental disorders (PDD). However, there is limited research that has examined multiple variables associated with sleep-wake characteristics and problems of children with PDD. This dissertation study assessed and examined the sleep-wake characteristics, sleep problems, and daytime problem behaviors of children with PDD aged three to fifteen years, and their caregivers' sleep as well as contextual variables using data from the primary caregivers' reports and recordings. This study confirmed several findings in the literature related to sleep-wake characteristics and sleep problems in children with both PDD and sleep problems. Although the relationship between sleep and daytime problem behaviors of the children was not found to be statistically correlated, the descriptive data indicated that some conditions such as illness or anxiety of the children negatively impacted their sleep and behaviors. In addition, the children participants with PDD and sleep problems tended to watch TV or to use computer/play video games before bedtime, in comparison to those with PDD but without sleep problems in this study. Moreover, a significant correlation between sleep of the caregivers and of their children was found in the group of children with PDD and sleep problems, but not in the other

group of children with PDD but without sleep problems. Lastly, the results of this study showed that the children with diagnoses of PDD were 3.84 times more likely to have sleep problems than those with diagnoses of Asperger's Disorder (AD) or PDD not otherwise specified (PDD-NOS). These findings are discussed in light of the similarities and differences between the current study and previous literature, and with respect to the implications for practice and research in the field of PDD and sleep.

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CHAPTER I: INTRODUCTION

Sound sleep is critical to cognition, mood, physical development, and quality of life (Institute of Medicine of the National Academies, 2006). Especially for school-age children, sleeping well is a protective mechanism that prevents physical and mental illness (Dahl, 1996). Children with intellectual disabilities (ID) are more likely to experience sleep problems when compared to children with typical development (TD) (Bartlett, Rooney, & Spedding, 1985; Clements, Wing, & Dunn, 1986; Didden, Korzilius, Smits, & Curfs, 2004; Robinson & Richdale, 2004; Quine, 1991, 2001; Wiggs & Stores, 1996). Moreover, children with pervasive developmental disorders (PDD) experience a higher prevalence of sleep problems than do their peers with other disabilities (Didden & Sigafoos, 2001; Johnson, 1996; Malow, 2004; Reynolds & Malow, 2011; Richdale, 1999).

This chapter differentiates sleep problems from sleep disorders, and presents an overview of available data-collection methods applied in sleep research. Next, the importance of good sleep among typically developing children is highlighted. Furthermore, an overview of sleep problems in children with intellectual disabilities (ID) is presented since most sleep research has targeted this broad population that includes children with PDD. Last, a brief summary of literature about sleep problems in individuals with PDD is presented to support the need for this dissertation study.

Sleep Problems and Measurements

Theoretically, a particular sleep disorder can be identified using the International Classification of Sleep Disorders (ICSD) (American Academy of Sleep Medicine, 2001) or the Diagnostic and Statistical Manual of Mental Disorders, fourth edition, text revision (DSM-IV-TR) (American Psychiatric Association, 2000), in conjunction with clinicians' diagnoses. However, researchers have usually adopted the broader terms sleep problems, sleep difficulties, or sleep disturbances, to investigate its nature (e.g., Bartlett et al., 1985;

Clements et al., 1986; Quine, 1991) or the effectiveness of certain interventions or strategies (e.g., Schreck, 2001; Thackeray & Richdale, 2002; Wiggs & France, 2000). Using practical, less diagnosis-oriented terms is especially important for treating children because of the difficulties of assessing and diagnosing them and of determining the preventive approaches once signs of disturbances occur during sleep (Stores, 1992).

Sleep problems can be assessed using subjective or objective methods. In the case of subjective sleep measures, sleep-related information is gathered from individuals' or caregivers' retrospective reports or recordings. Subjective sleep measures can include sleep questionnaires, sleep diaries, and clinical interviews. For example, the Child's Sleep Habits Questionnaire (CSHQ) by Owens, Spirito, and McGuinn (2000) is a questionnaire designed to identify the need for further evaluation of sleep problems in four through twelve year-old children. The CSHQ consists of 48 three point Likert-scale questions that represent eight subscales of sleep problems. These subscales include bedtime resistance, sleep onset delay, sleep duration, sleep anxiety, night waking, parasomnias, sleep disordered breathing, and daytime sleepiness. In addition to gathering information about sleep problems, some sleep questionnaires also include items assessing the daytime functioning of individuals' and their caregivers. Therefore, questions related to children's behaviors and anxiety as well as questions related to parental sleepiness, mental state, and beliefs or attitudes related to their children's sleep are included in some studies (Wiggs & Stores, 2004).

Sleep diaries require individuals or caregivers to collect specific information about sleep-related behaviors over a period of time, including bedtime/lights-off time, time of sleep onset (i.e., time when an individual falls asleep), awaking from sleep, subsequent return to sleep, morning rise time, and timing of daytime naps (Honomichl, Goodlin-Jones, Burnham, & Gaylor, 2002). Finally, some researchers have used clinical interviews to conduct sleep research, but interviews are less common than sleep questionnaires and/or sleep diaries because of the professional labor costs. Data from

interviews are similar to data from sleep questionnaires. However, when conducting an interview, researchers are able to timely clarify inconsistent responses with interviewees, which is harder to do when simply relying on questionnaires and/or sleep diaries.

For cost efficiency, researchers often use subjective sleep measures to survey the prevalence of sleep problems (Mindell & Owens, 2003; Stores & Wiggs, 1998). Subjective sleep measures also provide important information about perceptions of sleep problems from an individual's or a caregiver's perspective (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989; Roane, Piazza, Bodnar, & Zimmerman, 2000). Research has suggested a relationship between caregivers' sleep-related attitudes, beliefs, or practices and the presence of their children's sleep problems (Kerr & Jowett, 1994; Stores & Wiggs, 2001; Quine, 1991, 2001), and information gleaned from subjective sleep measures can provide important insights into these factors.

Objective sleep measures usually include polysomnographs (PSGs), actigraphs, or direct observations. PSGs provide a direct and comprehensive recording of multiple biophysiological parameters (e.g., brain electrical activities, eye and jaw muscle movements, leg muscle movements) that are recorded while an individual is sleeping (Bloch, 1997). PSGs require interpretation by clinicians with expertise in sleep medicine. Actigraphs, watch-like devices worn on the arm or leg that sense and record movements during sleep, are mainly used to show an individual's sleep-wake patterns (Morgenthaler et al., 2007). Direct observations can also be applied to measure sleep-related behaviors. For direct observation to occur, individuals either have to stay at a sleep laboratory where they can be observed, or caregivers have to repeatedly check (or allow researchers into their homes to check) on the targeted individuals throughout the night (Piazza, Fisher, Kiesewetter, Bowman, & Moser, 1990; Poindexter & Bihm, 1994).

PSGs or actigraphs are less commonly used in research targeting sleep problems of children or special populations who are sensitive to environmental changes or intolerant to objects attached to their bodies. Also, the practicality of and additional stress

associated with asking caregivers to do direct observations at home limit the application of this technique. For this reason, the subjective measurements mentioned previously, including sleep questionnaires and/or sleep diaries, are applied more commonly to children and to some other clinical populations.

The Importance of Good Sleep

Empirical research has demonstrated that sound sleep quality and quantity is critical to cognition, mood, physical development, and quality of life (Institute of Medicine of the National Academies, 2006; Leblanc et al., 2007; Sadeh & Gruber, 2002). Medical professionals advocate the importance of sleeping well, especially for school-age children because sleep is a protective mechanism that prevents physical and mental illness (Dahl, 1996). Researchers have also started to highlight the importance of sleep for the academic performance and cognitive development of children (Friedman, Corley, Hewitt, & Wright, 2009; Mitru, Millrood, & Mateika, 2002; Steenari, et al., 2003). They view sleep as a key issue in addressing the learning, behavioral, and emotional needs of school-age children.

The existing literature suggests that school-age children who experience sleep problems demonstrate more academic and behavior problems (BaHammam, Al-Faris, Shaikh, & Saeed, 2006; Meijer, Habekothé, & van den Wittenboer, 2000; Stein, Mendelsohn, Obermeyer, Amoromin, & Benca, 2001). Studies have shown that students who experienced sleep deprivation (i.e., slept less than five hours per night) significantly underperformed on tasks of assessing verbal processing, creativity, and abstract thinking (Randazzo, Muehlbach, Schweitzer, & Walsh, 1998), and showed more signs of anxiety (Gregory & Eley, 2005). Also, research has suggested that sleep problems in children can negatively impact overall family functioning (Schreck, Mulick, & Rojahn, 2005). Families of preschool children with persistent sleep problems are associated with higher incidents of child abuse and marital problems, which researchers suggest may be the

direct result of parents' or caregivers' chronic fatigue and feelings of desperation (Kerr & Jowett, 1994).

Sleep Problems and Intellectual Disabilities (ID)

Compared to typically developing children, individuals with ID are more likely to experience sleep problems (e.g., Bartlett et al., 1985; Clements et al., 1986; Didden et al., 2004; Robinson & Richdale, 2004; Quine, 1991, 2001; Wiggs & Stores, 1996). Individuals with ID are characterized by having disabilities that originate before age 18 and have significant limitations both in intellectual functioning and in adaptive behavior (Luckasson et al., 2002). The literature suggests that a younger age, lower intellectual functioning, severity of the disability, and the presence of additional medical conditions (e.g., epilepsy) or disabilities (e.g., sensory problems) may be risk factors for increased sleep problems in this population (Didden & Sigafoos, 2001; Quine, 1991, 1992, 2001; Richdale, Gavidia-Payne, Francis, & Cotton, 2000; Stores & Wiggs, 1998, 2001). Further, caregivers' attitudes regarding sleep and the practices they adopt to address sleep problems of their children with ID (e.g., handling of night wakings) may be strongly related to the occurrence of sleep problems in this population (Stores & Wiggs, 1998, 2001).

Sleep problems of individuals with ID tend to be more severe, persistent, and more strongly associated with daytime problem behaviors (e.g. tantrums, hyperactivity, aggression, self injury and non-compliance), than those of their typically developing peers. (Didden , Korzillius, van Aperlo, van Overloop, & de Vries, 2002; Quine, 1991; Stores & Wiggs, 2001; Symons, Davis, & Thompson, 2000). The presence of daytime problem behaviors in individuals with ID severely limits their participation in school and community activities and typically has a negative impact on the quality of their own lives and that of their family (Matson & Nebel-Schwalm, 2007; Sigafoos, Arthur, & O'Reilly, 2003). Sleep problems of individuals with ID may exacerbate the level of difficulties that

people confront when living or working with them (Jan et al., 2008; Wiggs, 2001). Therefore, not only parents and clinicians but also psychologists, administrators, teachers, and support staff must consider the impact of sleep problems when attempting to evaluate or improve performance or daytime functioning in individuals with ID (Quine, 1992; Wright, Tancredi, Yundt, & Larin, 2006).

Sleep Problems and Pervasive Developmental Disorders (PDD)

In studying individuals with ID, scholars have suggested that those with PDD experience a higher prevalence of sleep problems when compared to their peers with other disabilities (Didden & Sigafoos, 2001; Johnson, 1996; Malow, 2004; Reynolds & Malow, 2011; Richdale, 1999). By definition, the term PDD is utilized in preference to autistic disorder (autism) and other PDD, which include Asperger's disorder (AD), Rett syndrome, childhood disintegrative disorder, and PDD not otherwise specified (PDD-NOS) (National Institute of Mental Health, 2004). Based on the DSM-IV-TR (American Psychiatric Association, 2000), PDD are characterized by the onset of symptoms occurring in the first years of life and by severe and pervasive impairment in several areas of development: reciprocal social interaction skills, communication skills, or the presence of stereotyped behavior, interest, and activities.

Several studies have reported that overall daytime behaviors and autistic symptoms of individuals with PDD (e.g., stereotypic behaviors, social difficulties, and communication difficulties) are associated with their sleep problems (Hoffman et al., 2005; Hoshino, Watanaba, Yachima, Kaneko, & Kumashiro, 1984, Patzold, Richdale, & Tonge, 1998; Schreck, Mulick, & Smith, 2004; Segawa, Katoh, Ktoh, & Nomura, 1992). Furthermore, limited research has applied multivariate logistic regression techniques to examine multiple variables associated with sleep problems in children with PDD in order to explore possible risk factors of sleep problems in PDD (Doo & Wing, 2006; Liu, Hubbard, & Fabes, 2006). While younger age and lower intelligence quotient (IQ) have

been generally viewed to be risk factors for sleep problems in individuals with ID, research about sleep and PDD is inconclusive as to whether age or IQ are risk factors for sleep problems in individuals with PDD (Hoffman, Sweeney, Gilliam, & Lopez-Wagner, 2006; Hoshino et al., 1984; Patzold et al., 1998; Richdale & Prior, 1995; Schreck & Mulick, 2000).

Although sleep problems have never been part of the diagnosis of PDD, several studies have suggested that sleep problems may be an indicator of abnormal neural functioning in PDD (e.g., Hoshino et al., 1984; Limoges, Mottron, Bolduc, Berthiaume, & Godbout, 2005). Therefore, researchers have suggested that fully understanding sleep-wake characteristics in young children with PDD could advance our knowledge of the etiology of PDD and promote early intervention because sleep problems tend to occur very early in life (Dominick, Davis, Lainhart, Tager-Flusberg, & Folstein, 2007; Hoshino et al., 1984). More research is needed to understand the complexity of factors related to the sleep of children with PDD (Doo & Wing, 2006; Liu et al., 2006). This understanding is clinically relevant in order to provide direction for early prevention or intervention services and to develop educational services and support systems (Didden & Sigafoos, 2001; Dorris, Scott, Zuberi, & Gibson, 2008; O'Reilly & Lancioni, 2000). Therefore, the purpose of this dissertation study was to answer the following two research questions:

1. What are the sleep-wake characteristics of children with PDD who are between the ages of three and fifteen years old?
2. What are the relationships between sleep of children with PDD who are between the ages of three and fifteen years old and their daytime problem behaviors or other contextual variables related to the children or their primary caregivers?

A goal of this dissertation study was to apply statistics to investigate these questions because they have received limited attention in the literature (Doo & Wing, 2006; Dorris et al., 2008; Gena, 2007; Liu et al., 2006). Additionally, this dissertation

study examined the relationship between sleep and daytime problem behaviors in children with PDD.

CHAPTER II: LITERATURE REVIEW

This chapter consists of three main sections. The first section presents a summary of the studies that focus on the prevalence of sleep problems and/or the nature of sleep-wake characteristics in children with pervasive developmental disorders (PDD). The overall findings across the studies are summarized, and the implications for future research are addressed. The second section discusses the literature about the behavioral characteristics commonly seen in children with PDD. Studies examining the relationship between sleep and the behaviors of children with PDD are presented. Following this, the need for further studies about the sleep and behavioral characteristics of children with PDD is discussed. Finally, the third section of this chapter presents the demographic variables of children with PPD and those of their primary caregivers that have been found to correlate with their sleep.

Prevalence of Sleep Problems and the Nature of Sleep-Wake Characteristics in Children with PDD

Sleep can be assessed using subjective (e.g., sleep questionnaires, sleep diaries, interviews) and/or objective methods (e.g., polysomnographs, actigraphs, direct observations). However, subjective sleep measures, especially sleep questionnaires and/or sleep diaries, tend to be more commonly used in research targeting children with PDD (Mindell & Qwens, 2003; Stores & Wiggs, 1998). This is partially because objective sleep measures are too intrusive for children with PDD to tolerate (Hering, Epstein, Elroy, Iancy, & Selnik, 1999). Also, objective measures are time-, cost-, and labor-intensive for researchers to apply. Frequently, the research suggests a relationship between the attitudes and sleep-related practices of caregivers, and the presence of sleep problems in children with disabilities (Kerr & Jowett, 1994; Stores & Wiggs, 2001; Quine, 1991, 2001). Thus, using parent-reported sleep questionnaires and/or sleep diaries

is viewed to be a practical, effective, and efficient approach to gaining important information about sleep and sleep-related variables in children with PDD.

A growing body of research suggests that children with PDD experience a high prevalence of sleep problems (Didden & Sigafoos, 2001; Johnson, 1996; Malow, 2004; Reynolds & Malow, 2011; Richdale, 1999; Stores & Wiggs, 1998). However, studies investigating the prevalence of sleep problems and the nature of sleep-wake sleep characteristics in children with PDD are scarce and are characterized by methodological limitations (Gena, 2007; Polimeni, Richdale, & Francis, 2005; Souders et al., 2009). When compared to groups with other clinical diagnoses such as Down syndrome or attention deficit hyperactivity disorders (ADHD), children with PDD are more heterogeneous in terms of their characteristics of symptomatology and developmental or intellectual functioning. Preventive or early intervention services tend to be more efficient for children than for adolescents or adults. Therefore, this chapter will focus on reviewing the existing literature pertaining to sleep problems in children with PDD, age 15 years and younger.

Prevalence of sleep problems. A number of studies using subjective measures suggest that children with PDD experience a high prevalence of sleep problems (Didden & Sigafoos, 2001; Johnson, 1996; Malow, 2004; Reynolds & Malow, 2011; Richdale, 1999; Stores & Wiggs, 1998). Research also indicates that a high prevalence of sleep problems is associated with PDD across the whole spectrum of the diagnosis (Allik, Larsson, & Smedje, 2006a; Couturier et al., 2005; Richdale & Prior, 1995). That is, sleep problems are not necessarily higher in individuals with PDD and a lower IQ function, compared to individuals with PDD and a higher IQ or function.

Two types of data are available in the literature regarding the prevalence of sleep problems in children with PDD. Using descriptive analysis, Liu et al. (2006) surveyed 167 parents to inquire about the sleep patterns and sleep problems of their children with PDD between 5 and 14 years of age. The results showed that 86% of the participating

children with PDD had at least one sleep problem almost every day, including 54% with bedtime resistance, 56% with insomnia, 53% with parasomnias, 45% with morning rise problems, 31% with daytime sleepiness, and 25% with sleep disordered breathing.

In addition, Polineni et al. (2005) surveyed 53 parents of children/adolescents with autism (between 2 and 16 years of age), 52 parents of children/adolescents with Asperger's disorder (AD) (between 4 and 17 years of age), and 66 parents of children with typical development (TD) (between 2 and 11 years of age). They reported that the prevalence of sleep problems was higher in the autism and AD groups than the TD group (autism = 73%, AD = 73%, TD = 50%).

In contrast, using inferential analysis (i.e., statistically significant differences between groups), Allik et al. (2006a), Couturier et al. (2005), Devincent, Gadow, Delosh, and Geller (2007), and Patzold et al. (1998) conducted comparisons of the prevalence of sleep problems between children with PDD and those with TD. They all found that the prevalence of sleep problems in children with PDD was significantly higher than it was in their peers with TD.

The studies of Cotton and Richdale (2006), and Schreck and Mulick (2000) reported that sleep problems in children with PDD were significantly higher than in children with other types of disabilities or diagnoses (i.e., Down syndrome, mental retardation, developmental delays, Prader-Willi syndrome, or familial intellectual disabilities), and in children with TD. Krakiwiak et al. (2008) not only reported the descriptive data but also reported results of inferential analysis in their study of a well-characterized and population-based sample of 303 children with PDD (between 2 to 5 years of age). They found that 53% of children with PDD had at least one frequent sleep problem, followed by 46% of children with developmental delays, and 32% of TD children.

Furthermore, the study of Souders et al. (2009) used both subjective and objective measures to examine sleep problems among a well-representative sample of children with

PDD. They reported both descriptive and inferential data which showed that: (a) based on the parent-reported questionnaire, 66.1% of the children with PDD (62.5% autism, 58.3% AS, 76.2% PDD-NOS) and 45.9% of the TD children had sleep problems; and (b) based on the wrist-watch like microcomputer/actigraphy, 66.7% of the children with PDD (75% autism, 75% AS, 52.4% PDD-NOS) and 45.9% of the TD children had sleep problems.

Due to the differences in sample characteristics and questionnaires used to define sleep problems in children with PDD, it is impractical to directly compare the rates of prevalence for general or specific sleep problems reported across the studies. However, the literature has demonstrated that the prevalence of global sleep problems in children with PDD is very high (ranging from 53% to 86%), and is significantly higher than problems reported in TD children and some other clinical groups.

Nature of sleep-wake characteristics or sleep problems. To further describe the nature of sleep in children with PDD, examinations of sleep-wake characteristics have been undertaken. Several studies used at least one comparison group, TD children, to investigate sleep-wake characteristics or sleep problems in children with PDD (Allik, Larsson, & Smedje, 2006a, 2006b; Couturier et al., 2005; Goodlin-Jones, Tang, Liu, & Anders, 2008; Hering et al., 1999; Krakowiak et al., 2008; Malow et al., 2006; Patzold et al., 1998; Schreck & Mulick, 2000; Souders et al., 2009).

Some researchers viewed all of the participants with PDD as one unit, regardless of different subcategories of PDD identified for individual participants (e.g., Goodlin-Jones et al., 2008; Krakowiak et al., 2008; Patzold et al., 1998; Schreck & Mulick, 2000; Souders et al., 2009). In contrast, others divided their PDD group into two subgroups based upon the specific diagnoses (e.g., autism or AD) or upon another factor (e.g., individuals with PDD with sleep problems or without sleep problems) (e.g., Allik et al., 2006a, 2006b; Hering et al., 1999; Malow et al., 2006). They then compared these subgroups to the comparison group (i.e., TD or other clinical diagnoses).

For example, in the study of Hering et al. (1999), sleep characteristics are simultaneously compared among three groups: (a) children with PDD and with sleep problems; (b) children with PDD and without sleep problems; and (c) children with TD. In contrast, Malow et al. (2006) made two separate comparisons: (a) children with PDD and with poor sleep vs. children with TD; and, (b) children with PDD and with poor sleep vs. children with PDD and with good sleep.

Moreover, Allik et al. (2006a, 2006b) published two studies generating data from the same participants but consisting of different comparison designs. Both studies reported the differences in sleep-wake characteristics between participants with PDD and children with TD. However, in the first paper, Allik et al. (2006a) divided participants with PDD into two groups based on the presence or absence of sleep problems reported by their parents. In Allik et al. (2006b), participants with PDD were further divided into two groups of children with PDD, those showing the DSM-IV-adapted criteria for pediatric insomnia and children not experiencing insomnia. Focusing on the identification of sleep-wake characteristics that are more common in children with PDD than their TD peers in this chapter, the results of the two studies by Allik et al. (2006a, 2006b) are presented together.

Table 1 summarizes the statistically significant findings from the aforementioned comparison studies. Sleep-wake characteristics were reported more in children with PDD or in a subgroup of children with PDD, compared to TD children. Longer sleep latency was the most common problem reported among the studies (Allik et al., 2006a, 2006b; Couturier et al., 2005; Krakowiak, et al., 2008; Malow et al., 2006; Patzold et al., 1998; Souders et al., 2009). Shorter duration of sleep or lower sleep quantity (Couturier et al., 2005; Goodlin-Jones et al., 2008; Krakowiak, et al., 2008; Malow et al., 2006; Patzold et al., 1998; Souders et al., 2009) and waking problems (Hering et al., 1999; Krakowiak, et al., 2008; Patzold et al., 1998; Schreck & Mulick, 2000; Souders et al., 2009) were the next most common problems found across the studies.

Next, three studies showed that sleep anxiety was more common in children with PDD (Couturier et al., 2005; Malow et al., 2006; Souders et al., 2009). In addition, a number of studies reported that sleep-related problem behaviors were more common in children with PDD although the reported or targeted problem behaviors were different across the studies (Couturier et al., 2005; Krakowiak et al., 2008; Malow et al., 2006; Patzold et al., 1998; Schreck & Mulick, 2000; Souders et al., 2009). Similarly, several studies found that the timing of sleep was significantly different between children with PDD and TD children (Allik et al., 2006a, 2006b; Hering et al., 1999; Patzold et al., 1998; Souders et al., 2009).

Summaries. Although the number of existing studies in the literature is small, the literature has conclusively supported the notion that children with PDD have a higher prevalence of sleep problems than TD children and some other clinical groups. However, the literature focused on understanding sleep-wake characteristics of children with PDD yields less conclusive findings. The designs and sample comparisons are different from study to study, which makes it difficult to synthesize these findings into a clear pattern of sleep-wake characteristics that sufficiently describe children with PDD. This indicates a lack of systematic replications in the field where researchers adopt the same instrument to measure sleep-wake characteristics of children with PDD and use the same study design to describe sleep problems that are commonly reported by parents of children with PDD. Systematic replications of the research on sleep-wake characteristics in children with PDD are needed to support the development of interventions to promote good sleep in this population. This dissertation study uses well-developed and commonly-used subjective sleep instruments in the field to describe sleep-wake characteristics and sleep problems in children with PDD.

Table 1.

Sleep-Wake Characteristics Reported More in Children with PDD than in TD Children

Study \ Findings	Longer latency	Shorter duration	Waking problem	Sleep anxiety	Other characteristics
Patzold et al. (1998)	✓	✓	✓		a. Less readiness b. Later bedtime
Hering et al. (1999)			✓		a. Earlier offset time
Schreck & Mulick (2000)			✓		a. More disturbing behaviors b. More sensitive to stimuli in sleep environments c. More cessation of breathing & bruxism
Couturier et al. (2005)	✓	✓		✓	a. More parasomnias
Allik et al. (2006a, b)	✓				a. Earlier weekend bed & get-up time b. More daytime sleepiness c. Lower quality of sleep
Malow et al. (2006)	✓	✓		✓	a. More bedtime resistance
Krakowiak et al. (2008)	✓	✓	✓		a. More tantrums at bedtime & screaming at night b. Irregular bedtime
Goodlin-Jones et al. (2008)		✓			
Souders et al. (2009)	✓	✓	✓	✓	a. Waking earlier on both weekdays and weekends b. More parasomnias, including sleep terrors, bedwetting, and bruxism

Behaviors and Sleep in Children with PDD

According to the criteria employed to diagnose children with PDD (American Psychiatric Association, 2000), the following behaviors are typically seen in children with PDD: 1. Qualitative impairments in social behavior: (a) lack of nonverbal behaviors such as an eye-to-eye gaze, facial expressions, body postures, and gestures to regulate social interaction; (b) lack of development of peer relationships appropriate to developmental level; (c) lack of spontaneous desire to share enjoyment, interests, or achievements with other people; and/or, (d) lack of social or emotional reciprocity. 2. Qualitative impairments in communication: (a) lack of the development of spoken language, (b) lack of adequate speech, stereotyped and repetitive use of language, or idiosyncratic language; and/or, (c) lack of varied, spontaneous, make-believe play or social imitative play appropriate to developmental level. 3. Restricted, repetitive and stereotyped patterns of behaviors, interests, and activities, as manifested by at least one of the following: (a) encompassing preoccupation with one or more stereotyped and restricted patterns of interest that is abnormal either in intensity or focus; (b) apparently inflexible adherence to specific, nonfunctional routines or rituals; and/or, (c) stereotyped and repetitive motor manners.

The impairments typically seen in children with PDD may predispose them to develop problem behaviors (Ma, 2009). Restricted, repetitive, and stereotyped behaviors of children with PDD, such as rocking, sniffing objects, spinning, waving arms, head rolling, whirling, pacing, twirling, hand or finger movements, gazing, rubbing self, manipulating, or rhythmical, repetitive patterns of movement, are problematic because they are incompatible with learning and communication and stigmatize the children who show these behaviors (Joosten, Bundy, & Einfeld, 2009; Nijhof, Joha, & Pekelharing, 1998; Durand & Carr, 1987). Additionally, children diagnosed with PDD are at an increased risk for developing other problem behaviors that include, but are not limited to,

aggressive/destructive behaviors and self-injury behaviors (Rojahn, Matson, Lott, Esbensen, & Smalls, 2001). Examples of aggressive/destructive behaviors are hitting, kicking, pushing, biting, grabbing, pulling, scratching, pinching, spitting, verbal abuse, or cruelty. Self-injury behaviors can be head hitting, body hitting, self scratching, vomiting, self-pinching, pica, stuffing objects, nail pulling, poking, aerophagia, hair pulling, or teeth-grinding.

Problem behaviors may result from the impairments in children with PDD and may serve the function of communication, gaining of needs (subjects or attention), escaping from disliked conditions, and/or automatic reinforcement (Hall, Thorns, & Oliver, 2003). Two main approaches used to intervene in problem behaviors of children with PDD are to change the consequences of problem behavior and/or to re-arrange antecedent conditions before problem behaviors occur (Bambera & Kern, 2005). Studies have shown that sleep problems are associated with daytime problem behaviors in children with PDD (Patzold et al., 1998; Richdale & Prior, 1995). In addition, Hoshino et al. (1984) reported a negative correlation between the developmental level and the duration period of sleep problems among children with PDD. That is, children in their study with poor function showed a longer period of having sleep problems; those with better function had a shorter period of having sleep problems. These correlation studies cannot explain the causal relationship between PDD, problem behaviors, and sleep problems. However, considering children's sleep quantity and quality as an antecedent variable, for example, during the assessment of problem behaviors in children may therefore greatly help shape a successful intervention plan that can decrease problem behaviors and increase positive behaviors (Didden & Sigafoos, 2001; O'Reilly & Lancioni, 2000). Several studies have shown that intervening with the sleep problems in individuals with ID or mental retardation results in improvement of daytime problem behaviors (Durand, Gernert-Dott, & Mapstone, 1996; O'Reilly, 1995; Thackeray & Richdale, 2002; Wiggs & Stores, 1998).

In contrast, instead of viewing sleep as an intervention's contextual variable for the occurrence of daytime problems behaviors of children with PDD, several studies closely examined the relationship between sleep problems and symptomatology (i.e., the typical behaviors used in the diagnose process for PDD or the fundamental diagnostic characteristics of PDD) or between sleep problems and comorbid psychiatric symptoms or behaviors (e.g., hyperactivity, depression, anxiety) in children with PDD (DeVincent et al., 2007; Hoffman et al., 2005; Hoshino et al., 1984; Mayes & Calhoun, 2009; Schreck et al., 2004; Segawa et al., 1992).

A preliminary theory these studies have proposed is that when a strong association between the sleep-wake characteristics or sleep problems and the typical (problem) behaviors in children with PDD is present, intervening with the sleep problems of children with PDD may decrease the severity or the occurrence of problems behaviors of children with PDD. Consequently, intervening with the sleep problems in children with PDD may further improve children's learning outcomes indirectly.

For example, in the study of Schreck et al. (2004), sleep-wake characteristics of the participants were based on the Behavior Evaluation of Disorders of Sleep (BEDS) developed by Schreck (1997). The BEDS consists of 22 five-point Likert scale items and a four-factor scale: (a) Factor 1, expressive sleep disturbances; (b) Factor 2, sensitivity to the environment; (c) Factor 3, disoriented awakenings; and, (d) Factor 4, apnea. On the other hand, the symptomatology of PDD is determined by the Gilliam Autism Rating Scale (GARS) (Gilliam, 1995). The GARS provides measurements of stereotyped behavior, communication, social interaction, and developmental disturbances. Schreck et al. (2004) reported that communication problems of children with PDD were significantly associated with increased sensitivity to stimuli in the sleeping environment (Factor 2) and by periods of screaming during the night (Factor 1). This indicates that children with PDD who have more typical PDD communication behaviors are more sensitive to their sleep environment, and tend to scream and awake at night. Additionally, the BEDS

Factor 2 was found to be a significant predictor of developmental disturbances in the GARS. Also, the BEDS Factor 1, in combination with fewer hours of sleep per night, predicted the results of increased stereotypic behaviors in the GARS. Moreover, fewer numbers of hours slept per night predicted difficulties with social interaction (GARS subscale) and overall diagnostic characteristics of PDD (GARS' overall autism quotient).

Hoffman et al. (2005) replicated the study of Schreck et al. (2004) presented above. However, Hoffman et al. used the Children's Sleep Habits Questionnaire (CSHQ) developed by Owens et al. (2000), instead of the BEDS to identify sleep-wake characteristics or sleep problems of children with PDD, due to the wide use of the CSHQ in sleep literature of TD children and other clinical groups of children. The CSHQ is composed of eight subscales, including bedtime resistance, sleep onset delay, sleep duration, sleep anxiety, night wakings, parasomnias, sleep disordered breathing, and daytime sleepiness. Also, the CSHQ can provide a total sleep disturbance score.

Hoffman et al. (2005) reported that sleep-disordered breathing predicted children's stereotyped behavior, social interaction problems, and the GARS' overall autism quotient (AQ). In addition, the parasomnias in the CSHQ scores predicted developmental disturbances in the GARS scores. Moreover, both the sleep disordered breathing and the daytime sleepiness subscales correlated significantly with the stereotyped behavior and the social interaction subscales of the GARS, and the GARS' AQ. Lastly, the CSHQ's total sleep disturbance scores correlated with the GARS's subscales of stereotyped behavior, social interaction, developmental disturbances, and AQ.

In contrast, Mayes and Calhoun (2009) adopted several self-developed instruments that were scored by different parties (i.e., parents, clinicians, and teachers) to evaluate autistic behaviors and comorbid psychiatric behaviors of children with PDD. Most importantly, the study consisted of 477 children with PDD, which is a larger sample size than the earlier two studies. The scores of the autistic behaviors rated by parents and

clinicians were found to be significantly associated with sleep problems of children with PDD. In addition, Mayes and Calhoun (2009) reported that "the most powerful predictor of sleep disturbance were parent ratings of autism severity, hyperactivity, mood variability, and aggression, yielding an R of .57 (explained variance 31%) " (p. 937).

Conclusions. Although more research is needed to support the notion that daytime problem behaviors of children with PDD are associated with their particular type of sleep problems, researchers suggest that interventions developed to address specific sleep problems in children with PDD would make a positive impact on the daytime behaviors of children with PDD (Gena, 2007). Since the statistical results of correlation cannot explain the causal indication between variables, this dissertation study examined whether sleep would impact the daytime problem behaviors on a daily basis (i.e., using consecutive two-week data of sleep and behaviors). This micro approach of examining sleep and daytime problem behaviors of children with PDD has not been conducted in the literature. However, it would offer insights, regarding the quality of sleep a child has and its potential impact on their daytime behaviors the next day.

Contextual Variables of Sleep in Children with PDD

Although the severity of autistic symptomatology and comorbid psychiatric symptoms has been found to explain up to about one-third of the variance of sleep problems (Mayes & Calhoun, 2009), researchers recommend that other variables should also be included in order to better understand sleep problems and daytime problem behaviors of children with PDD (Hoffman et al., 2005; Schreck et al., 2004). Ultimately, information on those contextual variables will help shape not only effective but efficient early preventive sleep interventions for families of children with PDD.

This last part of Chapter 2 discusses the association of sleep problems in children with PDD and several variables pertaining to children with PDD, including their intellectual level (e.g., IQ), age, sex, and medication use, which have been examined in

the literature. Next, a few familial variables, including socioeconomic status, race, maternal sleep, maternal education, and maternal occupation are reviewed.

Variables pertaining to children with PDD. Regarding the relationship between IQ and sleep problems in children with PDD, Patzold et al. (1998) reported that sleep problems occurred at similar rates in those with PDD who had a wide range of intellectual levels, not just in those with lower intellectual functioning. Furthermore, Allik et al. (2006a, 2006b) targeted sleep problems in children with either Asperger's disorder (AD) or high-functioning autism; about 60% of their participants had sleep problems at the time of their investigation. The relationship between IQ and sleep problems, with the exception of nightmares, in children with PDD was also found to be non-significant in the study of Mayes and Calhoun (2009).

In terms of the relationship between age and sleep problems in children with PDD, Patzold et al. (1998) and Schreck and Mulick (2000) reported that children with PDD continued to have sleep problems as they aged. Similarly, Mayes and Calhoun (2009) found that overall sleep problems and six of seven sleep-wake characteristics of children with PDD (i.e., difficulty falling asleep, restless during sleep, nightmares, walks or talks in sleep, wakes too early, and sleep less), did not show a significant association with their age, with the exception of wakes during the night,. Also, three other studies targeting only adolescents and adults with PDD have suggested that sleep problems are still prevalent and persist into the adulthood of individuals with PDD (Limoges et al., 2005; Øyane & Bjorvatn, 2005; Tani, et al., 2003).

In contrast, four studies found that participants were more likely to have sleep problems in general or to have certain types of sleep-wake characteristics when they were younger or had a lower IQ, compared to those at an older age or with a higher IQ (Doo, & Wing, 2006; Hoffman et al., 2006; Hoshino et al., 1984; Richdale & Prior, 1995). Richdale and Prior (1995), for instance, reported that their participants younger than eight years old with PDD, who had an IQ below 55, were sleepier and engaged in more

daytime napping, and that participants younger than eight years old with PDD, who had an IQ above 55, were waking earlier. In another example, Hoffman et al. (2006) found that the younger participants with PDD showed more bedtime resistance and sleep anxiety than the older participants with PDD. Hoshino et al. (1984) also found that participants with PDD and a lower IQ were more likely to have sleep problems than those with PDD and a higher IQ. In addition, Doo and Wing (2006) found that the age of the child was a protective factor. That is, the older the children were, the fewer night waking problems the children had. They also reported that the presence of a sleep problem before the age of two was a significant risk factor of having sleep problems, but a borderline (milder) developmental delay was a protective factor of having sleep problems in children with PDD (Doo & Wing, 2006).

Several studies have examined the association between medication use and the gender of children with PDD with their sleep problems (Liu et al., 2006; Krakowiak et al., 2008; Mayes & Calhoun, 2009; Patzold et al., 1998; Polimeni et al., 2005). Three of the studies reported that children with PDD who took psychoactive medication showed more sleep problems than those with PDD who were not taking psychoactive medication (i.e., Liu et al., 2006; Krakowiak et al., 2008; Mayes & Calhoun, 2009). However, Patzold et al. (1998) and Polimeni et al. (2005) reported no differences between the sleep problems of children with PDD who were using psychoactive medication and those not using psychoactive medication.

Lastly, regarding the differences in sleep problems between male and female children with PDD, four studies consistently reported that there existed no differences between genders (DeVincent et al., 2007; Liu et al., 2006; Mayes & Calhoun, 2009; Wiggs & Stores, 2004).

Familial variables. Research targeting a broad population has shown that families of children with intellectual disabilities (ID) and with sleep problems had a significantly greater frequency and intensity of daily challenges than those without sleep

problems (Richdale et al., 2000). Primary caregivers of children with ID and with sleep problems are at risk of having sleep problems and have higher stress levels, which may directly or indirectly cause further family problems (Honomichl et al., 2002; Quine, 1991, 2001; Stores, 1992).

Hoffman and colleagues (2008) reported that mothers' sleep, severity of children's autistic symptoms, and children's sleep problems were significant predictors for maternal stress. In another study, the parents of children with PDD and sleep problems were found to experience a higher level of stress than parents whose children did not have sleep problems (Doo & Wing, 2006). Therefore, Doo and Wing (2006) suggested that children's sleep problems should be included in the study of stress in mothers of children with PDD. Moreover, a qualitative study using videotaped interviews investigated the parental experience of children with Rett syndrome and sleep problems (McDougall, Kerr, & Espie, 2005). McDougall and colleagues (2005) reported that six out of nine participating families expressed that their own sleep was affected by the children's sleep disturbances, and the children's sleep disturbances had negative effects on the parents' mood and irritability.

In contrast, the existing literature regarding the relationship between the sleep problems of children with PDD and variables of maternal education, parent occupation, race, or socioeconomic status, shows contradictory results. Krakowiak et al. (2008) reported that maternal education and sleep duration of children with PDD were significantly associated. They found that the higher a mother's education was, the longer her child slept. However, several studies did not find any significant correlation between the sleep of children with PDD and either their mothers' educational, racial or socioeconomic status (DeVincent et al., 2007; Liu et al., 2006; Mayes & Calhoun, 2009; Wiggs & Stores, 2004).

Lastly, regarding parental sleep-related practices, Doo and Wing (2006) reported that sharing a room with parents or grandparents and having a working mother were

associated with a lower risk of sleep anxiety. However, Cotton and Richdale (2006) suggested that co-sleep of children with PDD may be promoted by their poor settling sleep habits and night-time fears.

Conclusions. Except for the gender variable, studies showed inconsistencies between the contextual variables examined and sleep problems in children with PDD. One of the reasons for this, researchers have implied, is the heterogeneity of samples used across the studies. Including only participants with normal-IQ PDD and without any comorbidity can address the issue of inconsistencies (Limoges et al, 2005). Alternatively, in-depth data including demographic information of participating families of children with PDD should be collected (Hering et al., 1999). Then, different findings from individual studies can be well generalized to a particular sub-group of children with PDD.

Additionally, researchers suggest that some other variables should be included in future studies, such as parents' beliefs about the main cause of their children's sleep and the parents' sleep hygiene practices (Cotton & Richdale. 2006; Wiggs, & Stores, 2001; Keenan, Wild, McArthur, & Espie, 2007). Therefore, this dissertation study measured the contextual variables and reports in-depth descriptions of the participating families of children with PDD. In summary, there is an imperative need for research on PDD and sleep. Thus, this dissertation study sought to examine the nature of sleep-wake characteristics, sleep problems, and related variables of the children with PDD and their primary caregivers, particularly from the perspective of caregivers.

CHAPTER III: METHOD

This study examined the sleep of children with pervasive developmental disorders (PDD) between the ages of three and fifteen years old. The research inquiries included the sleep-wake characteristics and sleep problems of children with PDD, and the relationships between sleep and behaviors of children with PDD. This chapter describes the research method and questions, participants and their recruitment, instrumentation, procedures of data collection, and data analyses used in the study.

Research Method and Questions

The present study used the survey methodology that has been and will be an effective and important means of gathering, analyzing, and interpreting data related to human health (Aday & Cornelius, 2006). This study involved the administration of three questionnaires, one diary, and one checklist filled by the primary caregivers and teachers/therapists of the children with PDD, in order to answer the two main proposed research questions:

1. What are the sleep-wake characteristics of children with PDD who are between the ages of three and fifteen years old?
2. What are the relationships between sleep of children with PDD who are between the ages of three and fifteen years old and their daytime problem behaviors or other contextual variables related to the children or their primary caregivers?

Participants and Recruitment

For this study, families of children with PDD were invited by emails or E-newsletters through: (a) Autism Society of America, (b) Center for Autism and Related Disorders, (c) Thoughtful House Center for Children, (d) Autism Community Network, and (e) Bluebonnet Trails Community Mental Health & Mental Retardation Center. Emails were also sent to over one hundred autism-focused parent groups on Internet

websites such as Yahoo, Meetup, and Facebook. The present study recruited primary caregivers of the children with PDD between the ages of three and fifteen years old. To verify the children's diagnosis of PDD, caregivers who were interested in participating were asked to provide the name and contact information of the clinicians who had made the diagnosis of the children. Caregivers with children who were diagnosed with PDD within three months from the start of the study were excluded because they usually tend to confront many challenges or difficulties during that time. Because the instruments used in the current study were written in English only, all participating caregivers of children with PDD had to be capable of reading and writing English.

Forty-five primary caregivers and their 49 children with PDD participated in the first part of the study in which three instruments were completed. Thirty-seven primary caregivers and their 41 children completed all the procedures for the study. The completion rate of the children participants was 84%. The ages of the children at the beginning of this part of the study ranged from 3 years 4 months to 13 years 2 months (M = 98 months, SD = 70 months).

Instruments and Measures

Pediatric Sleep Clinic Questionnaire (4 - 12 years old) (PSCQ). The PSCQ is a parent-report questionnaire developed by the Sleep Disorders Center of Lifespan (http://www.lifespan.org/centers-and-services/sleep-resources/sleep-disorder-center), a multidisciplinary program designed to provide comprehensive assessment and treatment for adults and children with a variety of sleep problems. The PSCQ is mainly designed to gain general information related to a child's sleep problems that are of concern to his/her caregiver. Family information, sleep history (general and daytime sleepiness), medical history, health habits, development history, and beliefs about sleep are covered by this instrument. The original PSCQ consists of a total of 63 items. The present study adopted only 41 items to gain information related to the research questions here. It takes

approximately 30 minutes to complete the abbreviated-version of the PSCQ that was used by the present study. Primary caregivers of the children with PDD were asked to fill out this abbreviated-version of the PSCQ at the beginning of the study. The PSCQ used in the present study is attached in Appendix A.

Children's Sleep Habits Questionnaire (CSHQ). The CSHQ is a retrospective parent-report, 3-point Likert-scale instrument developed by Owens and colleagues (2000) (see Appendix B). It can be used with children aged four through twelve years old to identify both behaviorally and medically based sleep problems. In addition, there are eight statistically derived subscales, including bedtime resistance, sleep onset delay, sleep duration, sleep anxiety, night wakings, parasomniass, sleep disordered breathing, and daytime sleepiness. The design of the CSHQ is not intended to be used to diagnose specific sleep disorders, but rather to identify the need for further evaluations. The higher a final Total Sleep Disturbance Score is, the greater the sleep problems are. When a child has a Total Sleep Disturbance Score of above 41, his/her sleep problems are considered to fall into the "clinical" range. Moreover, the test-retest reliability has been found to range from .62 to .79, with subscale and total test scores found to differ consistently for the community and clinical samples (Owens et al., 2000). However, there are no established norms for the total and subscale scores. Therefore, the developers of the CSHQ have suggested that the CSHQ is more useful in comparing different groups or in assessing effectiveness of sleep interventions. Approximately 20 minutes is needed to complete the CSHQ. The primary caregivers of the children with PDD were asked to complete the CSHQ at the beginning and the end of the current study.

Pittsburgh Sleep Quality Index (PSQI). The PSQI developed by Buysse et al. (1989) is a widely used questionnaire to evaluate multiple dimensions of sleep quality. This questionnaire consists of 19 self-reported and retrospective questions that cover seven components of sleep, including subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, use of sleeping medication, and

daytime dysfunction. The sum of the seven component scores forms a global score, ranging from zero to 21. A cut-off score of five or greater is indicative of poor sleep quality. The statistical analyses of the PSQI have demonstrated acceptable measures of internal homogeneity, test-retest reliability, criterion validity as well as sensitivity and specificity in distinguishing good and poor sleepers (Buysse et al., 1989). Usually, it takes about five minutes to fill out this instrument (see Appendix C). In the current study, the primary caregivers of the children with PDD completed the PSQI for their own sleep at the beginning and the end of the study participation.

Sleep diary. The sleep diary used in this study was revised from the National Sleep Foundation Sleep Diary (http://sleep.buffalo.edu/sleepdiary.pdf). The primary caregiver participants used this tool to retrospectively record the participating child's in-bed time, out-of-bed time, falling-asleep time, night-waking behaviors, medication use, naps, and other significant events that occurred during the day or before bedtime (see Appendix D). The first half of the diary sheet was completed at the end of each day, and then the other half was filled out the next morning. It takes about 15 minutes to complete each diary sheet. The participating caregivers in this study were asked to record their child's sleep for two weeks (14 days in total), starting on any Saturday.

Problem behaviors checklist. This checklist developed by the researcher in the present study was used to record the frequency or duration and intensity of problem behaviors in the children (see Appendix E). The development of this checklist was based on the problem behaviors of children with PDD that may commonly occur in a natural and familiar setting, such as school or home. In addition, this checklist was intended to be used by lay people without particular trainings. Teachers/therapists familiar with the participating children, or the caregivers themselves when no teachers/therapists were available, completed the checklist for 10 days (weekdays only) during the same time frame the sleep diaries were being used. Teachers/therapists or caregivers used this

checklist to record the daytime problem behaviors of the children after comparing the children's behaviors that day with their usual behaviors in the past.

The following table illustrates who completed which instrument(s) during the participation of the current study and when they did so. The shaded columns indicate that the recordings took place on that exact day.

Table 2.

Timeline of Completing the Instruments

Instruments	PSCQ	CSHQ & PSQI	Sleep Diary	PBC
Who	Caregivers	Caregivers	Caregivers	Teachers/Caregivers
Date				
Saturday	By this day	By this day	Day 1	
Sunday			Day 2	
Monday			Day 3	Day 1
Tuesday			Day 4	Day 2
Wednesday			Day 5	Day 3
Thursday			Day 6	Day 4
Friday			Day 7	Day 5
Saturday			Day 8	
Sunday			Day 9	
Monday			Day 10	Day 6
Tuesday			Day 11	Day 7
Wednesday			Day 12	Day 8
Thursday			Day 13	Day 9
Friday			Day 14	Day 10
Saturday		This day		

Note. PSCQ: Pediatric Sleep Clinic Questionnaire; CSHQ: Children's Sleep Habits Questionnaire; PSQI: Pittsburg Sleep Quality Index; PBC: Problem Behaviors Checklist.

Procedures of Data Collection

There were two parts to the participation procedures in this study. For the first part of this study, the primary caregivers of the children with PDD received an intake package containing an overview of the study, its procedures and one copy of the PSCQ, CSHQ and PSQI by email and/or mail. On completion of the clarification about the study participation, the caregivers emailed or mailed back the signed consent document for

participation. At the same time or later, the caregivers sent back the first set of the completed PSCQ, CSHQ, and PSQI.

Once the researcher in this study received the first set of the completed PSCQ, CSHQ, and PSQI from the caregiver participants, the caregiver participants were instructed how to start their second part of the study participation. The second package of the study materials, which were sent out by mail and/or email to the caregivers, included 14 copies of the sleep diaries, 10 copies of the problem behaviors checklists and the second set of the CSHQ and PSQI. The caregivers were instructed to inform the researcher when they initiated the 14-day recordings, so the researcher was able to provide reminders to the caregiver participants through either email or phone calls. At the end, the caregiver participants were asked to send all of the completed materials to the researcher.

After receiving all of the documents from the caregiver participants, the researcher compared the answers between two sets of the CSHQ and PSQI that were completed before and after the 14-day recordings of the sleep diary and problem behaviors checklist. Although only the first set of the CSHQ and PSQI was used for the following statistical analyses, the caregiver participant was contacted to reconsider the question(s) in the circumstance when any answer resulted in a big difference (e.g., from a "rarely" to "usually" response or from "Yes" to "No") among two sets of the same instrument. At the end, after their data was reviewed and further contact was ended, participants received a check for $33.00 for each child participant.

Statistical Analyses

The data collected were all coded and organized into Excel tables after the completion of data collection. Before any specific analysis was conducted, the targeted variables were retrieved, copied, and stored into a separate Excel file. Then the statistical techniques were used to synthesize data. The descriptive statistical techniques, including

frequencies, means, mode, standard deviation, and/or range, were used to determine the demographics, the sleep-related characteristics and sleep problems of the participating children with PDD, and the sleep quality of the primary caregivers of the children with PDD. Where appropriate, inferential statistics, such as t tests, chi-square and factor analyses were applied with the IBM SPSS package, version 20, to determine the relationship between the key variables investigated. Details of the statistics employed in this study are presented in the next chapter.

CHAPTER IV: RESULTS

This chapter presents the results of the current study. First, the demographic information about the primary caregiver participants and their children participants with pervasive developmental disorders (PDD) are described. Second, the sleep-wake characteristics and sleep problems of the children with PDD, with or without sleep problems, are summarized and compared. Finally, the relationship between sleep-wake characteristics or problems of children, caregivers' sleep, demographics of contextual variables, and the children's daytime behaviors are reported as well.

Demographic and Contextual Information of the Participants

There were 49 children participants with PDD in the first part of this study in which caregivers had to provide the written consent and complete three out of five instruments, including the Pediatric Sleep Clinic Questionnaire (PSCQ), the Children's Sleep Habits Questionnaire (CSHQ), and the Pittsburgh Sleep Quality Index (PSQI). Forty-one out of the 49 children participants had their caregivers complete the second part of the study that included two-week recordings with the sleep diaries and the problem behaviors checklists, followed by the repeated CSHQ and PSQI measurements at the end. The completion rate of materials about children participants was 84%.

Although this study mainly used the first set of the CSHQ and PSQI for analyses, the second set of the CSHQ and PSQI, which were completed at the end of the study participation, was used to verify for reliability among the same reporters (i.e., caregivers). Unfortunately, eight caregivers as well as their eight participating children dropped out of the study without proceeding into the second part of the study. Therefore, the data of the CSHQ and the PSQI from those eight children were not compared to a second set of the CSHQ and the PSQI, after the two-week recordings of sleep and behaviors in the children participants.

Seven of the eight children participants who dropped out of the study had sleep problems reported by the caregiver participants. Reasons for discontinuity of participation in six families were unknown because the caregivers gave no responses after completing the first part of the study. One mother disclosed that her child's scheduled surgery would overlap with the time period of conducting the two-week recordings; her participation was discouraged and she agreed to terminate their involvement. The last mother participant stopped participating because she was starting an advanced education program.

Due to the difficulties of recruiting caregivers of children with PDD for a study that required a commitment longer than two weeks, and offered no significant compensations or direct benefits to either the caregiver or children participants, the data collected from the eight dropout families were included into the relevant data analyses in this dissertation study. The missing information from the eight dropouts included the 14-day sleep diaries and the 10-day problem behaviors checklists that were used to examine the relationship between the sleep, sleep-related behaviors, and daytime problem behaviors in the children with PDD. Therefore, the data analyses presented in this chapter are based on information pertaining to either a total of 49 or 41 children with PDD and their caregivers, accordingly. The following table illustrates the basic demographic information about caregiver and children participants who completed the first part of the study.

Table 3.

Demographic Information of the Participants

Caregiver Participants (n = 45)		Children Participants (n = 49)	
Marital status		Race	
Married	40 (89 %)	Caucasians	36 (73 %)
Divorced	1 (2 %)	Multiracial	6 (12 %)
Separate	2 (4 %)	Asian American	3 (6 %)
Single	2 (4 %)	Hispanic	3 (6 %)
		African American	1 (2 %)
Education		Age (months)	
High School	3 (7 %)	Mean (SD)	98 (70)
Some College or more	42 (92 %)	Range	40-158
		<60	11 (23 %)
		60-132	31 (63 %)
		132-168	7 (14 %)
Work status		PDD diagnoses	
No	18 (40 %)	Non-specific PDD	31 (63 %)
Full-time	20 (45 %)	AD	11 (23 %)
Part-time	7 (15 %)	PDD-NOS	7 (14 %)
		Comorbidity	
		Speech impairments	26 (53 %)
		ADHD / ADD	7 (14 %)
		Anxiety/behavior disorders	7 (14 %)

Note. SD: standard deviation; AD: Asperger's disorder; PDD-NOS: PDD not otherwise specified; ADHD/ADD: attention-deficit/hyperactivity disorder.

The Pediatric Sleep Clinic Questionnaire (PSCQ) was used in this study to report the contextual variables related to the research questions. The primary caregivers of the children with PDD completed this questionnaire for their participating children with PDD. Twenty-nine participating children were reported having sleep problems and the remaining 20 were reported not having sleep problems by their primary caregivers. The age range of the participating children with sleep problems was between 48 and 138 months, and the average was 89 months (SD = 56). In contrast, the age range of the participating children without sleep problems was between 40 and 158 months, and the average was 97 months (SD = 120).

Among the 29 children with PDD and sleep problems, 22 (76%) were diagnosed with PDD, five (17%) were diagnosed with Asperger's disorder (AD), and two (7%) were diagnosed with PDD not otherwise specified (PDD-NOS). In contrast, the group of children with PDD but without sleep problems consisted of nine (45%) with PDD, six (30%) with AD, and five (25%) with PDD-NOS diagnoses. In addition to the diagnosis of PDD in the children, the group with sleep problems showed more comorbidities than those who did not have sleep problems. Within the group of children with sleep problems (n = 29), 18 were reported to have speech impairments, seven were reported to have attention-deficit/hyperactivity disorder (ADHD/ADD), five were reported to have behavior disorders and/or anxiety, two were reported to have metal retardation, two were reported to have auditory process disorder, and one was reported to have dyslexia. In contrast, within the group of children without sleep problems (n = 20), eight were reported to have speech impairments, and two were reported to have behavior disorders and/or anxiety.

Reasons for having sleep problems among the 29 children, as perceived by the caregivers, included: unknown, complication of PDD, hyperactivity, mood disorder, anxiety or fear, inability of the brain or mind to rest, food intolerance, or lack of strict sleep schedule/bedtime routine. All but two of 29 children with PDD and sleep problem were reported to have started showing sleep problems at birth, in infancy, or at a young age (before the age of four). The other two parents reported that the child's sleep problems started or got worse around the age of 10.

Next, the PSCQ asked caregivers about their participating children's medication use. The results showed that during their participation in the study the children with PDD and sleep problems took more medications than those with PDD but without sleep problems. The most commonly used medicine by the children in this study was Melatonin. Eleven children in the group with sleep problems and one in the group without sleep problems were taking Melatonin. Melatonin is an over-the-counter

medicine that is usually used for trouble falling asleep and/or maintaining sleep. The second most common medication used by the children participants was Clolidine; four children in the group with sleep problems were taking Clolidine during their participation. This medication is usually prescribed for sleep and/or ADHD-related behavioral problems. Some other medications, including Abilify (Aripiprazole), Focalin (dexmethylphenidate), Concerta (Methylphenidate), Depakote (Divalproex Sodium), Intunix (Guanfacine), Lexapro (Escitalopram), Methylin (Methylphenidate), Risperidone, Ritalin (Methylphenidate), Seroquel (Quetiapine), Strattera (Atomoxetine), Trileptol (Oxcarbazepine), or Vyvanse (Lisdexamfetamine), were taken by one to two children in both children groups.

When asked the main reason that their children with PDD go to bed at a particular time, some caregivers circled more than one reason. Most of them, no matter whether their children were having sleep problems or not, reported that getting enough sleep for the following day's activities was the main reason to have the child go to bed at a particular time. The second most frequently chosen reason by the caregivers of the children with PDD and sleep problems was because the child felt sleepy. In contrast, the second most frequently chosen reason by the caregivers of the children with PDD but without sleep problems was because of the best fit for the family's schedule. Moreover, the following reasons were provided by six caregivers of the children with PDD and with sleep problems: (a) an early bedtime made the child wake up early, so the child went to bed late (1 child at 9:30 PM and another at 11:00 PM); (b) routines were set up years ago, so the child went to bed at a particular time; and, (c) bedtime was instructed by the physician either for medication and tube feeding, or for monitoring sleep patterns.

Regarding caffeine intake and television watching habits of the children, the group of children with sleep problems and the other group of children without sleep problems showed similar patterns (see Table 4). Other demographic information reported in the PSCQ such as children's medical history, education placement, school attendance,

behavioral or mental problems, and participation in activities or groups, did not show significantly different patterns between the two groups of children.

Table 4.

Caffeine Intake and Television Watching Habits

Group	Caffeine intake	TV watching	TV in bedroom
Children with PDD and sleep problems (n = 29)	<1 glass: 3 (10%) None: 26 (90%)	Every night: 6 (21%) 5-6 nights: 2 (7%) 3-4 nights: 6 (21%) 1-2 nights: 6 (21%) None: 9 (30 %)	Yes: 6 (21%) No: 23 (79%)
Children with PDD but without sleep problems (n = 20)	<1 glass: 2 (10%) None: 18 (90%)	Every night: 4 (20%) 5-6 nights: 1 (5%) 3-4 nights: 1 (5%) 1-2 nights: 7 (35%) None: 7 (35%)	Yes: 3 (15%) No: 17 (85%)

In addition, the question regarding the occurrence of sleep problems in the participating children's other family members indicated that the prevalence was high across all families of both groups of children. Only three participating caregivers reported no sleep-related problems in other family members. As expected, the caregiver participants of the four adopted children were not able to answer whether the child's biological family members had sleep-related problems or not.

Furthermore, questions about the sleep beliefs of parents showed that all but one question (i.e., "Do you think most children get enough sleep?") were answered with similar patterns between two caregiver groups (i.e., caregivers of the children with PDD and sleep problems *vs.* those of the children with PDD but no sleep problems). When compared to the caregivers of the children with PDD but without sleep problems, more caregivers of the children with PDD and sleep problems answered "don't know" to the question of whether most children get enough sleep (i.e., 31% vs. 15%). Also, more than half (65%) of the caregivers of the children with PDD but without sleep problems thought

most children don’t get enough sleep. In contrast, 12 caregivers (41%) of the children with PDD and sleep problems thought most children don’t get enough sleep. Overall, the caregivers participating in the present study tended to believe that most children don’t get enough sleep.

Sleep-Wake Characteristics and Problems in Children with PDD

To examine sleep-wake characteristics and sleep problems in children with PDD, this study mainly relied on the results from the Children's Sleep Habits Questionnaire (CSHQ) completed by the caregiver participants during the first part of the study, in addition to the PSCQ. The data from the PSCQ about bedtime and wake up time of the children during weekdays or on weekends, showed that the children with PDD and sleep problems had a wider time range than those with PDD but without sleep problems. Table 5 summarizes the average, range, and mode of the bedtime as well as wakeup time on weekdays and weekends in both groups of children with PDD.

Table 5.

Bedtime and Wakeup Time During Weekdays and on Weekends

Group	Bedtime	Wakeup time
Children with PDD and sleep problems (n = 29)	Weekdays Average: 8:27 PM Range: 6:45 PM - 12:30 AM Mode: 8:30 PM	Weekdays Average: 6:43 AM Range: 5:00 - 11:00 AM Mode: 6:30 AM
	Weekends Average: 9:11 PM Range: 6:45 PM - 00:30 AM Mode: 8:00 - 8:30 PM	Weekends Average: 6:26 AM Range: 5:00 AM - 12:15 PM Mode: 6:00 AM
Children with PDD but without sleep problems (n = 20)	Weekdays Average 8:49 PM Range: 6:45 - 11:00 PM Mode: 8:00 PM	Weekdays Average: 6:46 AM Range: 5:30 - 7:45 AM Mode: 7:00 - 7:30 AM
	Weekends Average 8:59 PM Range: 7:00 - 10:15 PM Mode: 8:30 - 9:30 PM	Weekends Average: 7:24 AM Range: 5:30 - 9:50 AM Mode: 7:00 AM

The results showed that bedtimes on weekends were later than on weekdays within the two individual groups. However, the average time difference of the bedtime in

the children with PDD and sleep problems was greater than that of the children with PDD but without sleep problems. In other words, the weekend bedtime was similar to the weekday bedtime in the children with PDD but without sleep problems. In the children with PDD and sleep problems, their weekend bedtime was different from their weekday bedtime. Additionally, the children with PDD and sleep problems woke up slightly earlier on weekends than during weekdays. Therefore, children with PDD and sleep problems showed less total sleep time, on average, during weekends than weekdays, since they went to bed later and got up earlier on weekends. In contrast, the children with PDD but without sleep problems woke up later on weekends than on weekdays. So, the children with PDD but without sleep problems had a longer total sleep time on weekends than weekdays.

Analysis of the CSHQ completed by the caregiver participants during the first part of the study indicated that children with PDD and sleep problems had a higher Total Score (52 on average) than those with PDD but without sleep problems (47 on average). However, within the group of children with PDD but without sleep problems, only three of the children's Total Scores were below the cutoff score of the CSHQ (i.e., 41). That is, 17 out of 20 children with PDD but without sleep problems had a Total Score above the cutoff, which indicated that those children's sleep-wake characteristics were considered clinically problematic, and needed further evaluation.

Table 6 presents the statistical results of the comparisons of the CSHQ Total and Subscale Scores between the two children groups, based on their caregivers' reports. Furthermore, to test the significant differences of the CSHQ Total and Subscale scores between two children groups, t-tests were used. The results showed that the Total Scores of the children with PDD and sleep problems were significantly higher than that of the children with PDD but without sleep problems ($t = 2.946$, $p < .005$). Also, the scores of the subscales 2, 3, 5 and 6 of the children with PDD and sleep problems showed significantly higher than those of the children with PDD but without sleep problems.

Table 6.

CSHQ Mean Scores Between the Children With and Without Sleep Problems

Group	Children with sleep problems (n = 29)	Children without sleep problems (n = 20)	t	df	Sig. (2-tailed)
CSHQ					
Total Score	52	47	2.946	47	0.005*
Subscale 1	8.76	7.65	1.414	47	0.164
Subscale 2	1.86	1.30	2.521	47	0.015*
Subscale 3	5.41	4.20	2.569	47	0.013*
Subscale 4	6.14	5.60	1.002	47	0.321
Subscale 5	5.41	3.75	4.165	47	0.000***
Subscale 6[a]	10.24	8.95	2.296	46	0.026*
Subscale 7	3.59	3.60	-0.042	47	0.967
Subscale 8	13.93	14.15	-0.199	47	0.843

[a]Equal variances not assumed; * p< .05; **p<.005; *** p<.001

Note. Subscale 1: Bedtime Resistance (6 items); Subscale 2: Sleep Onset Delay (1 item); Subscale 3: Sleep Duration (3 items); Subscale 4: Sleep Anxiety (4 items); Subscale 5: Night Wakings (3 items); Subscale 6: Parasomnias (7 items); Subscale 7: Sleep Disordered Breathing (3 items); Subscale 8: Daytime Sleepiness (8 items).

Moreover, the following sleep-related characteristics of the children were reported by, and were considered problematic to one fourth or more of the caregivers of children with PDD and sleep problems in the CSHQ. The first group of the behaviors commonly reported by the caregivers of the children with sleep problems was related to waking during the night, including “child awakes once during the night (48%)”, “child awakes more than once during the night (45%)”, and “child needs help for returning to sleep after waking (35%)”. The next group of behaviors was related to morning waking, including “child seems tired (41%)”, “child wakes up very early in the morning (34%)”, “child does not have a good appetite in the morning (28%)”, and “child has difficulty getting out of bed in the morning (24%)”. Next, the caregivers reported problematic characteristics related to sleep behaviors, including “child has trouble sleeping away from home (e.g., visiting relatives, vacation) (31%)”, “child does not sleep about the same amount each day (24%)”, “ child moves to someone else’s bed during the night (e.g., parent, brother, sister, etc.) (24%)”, and “child grinds teeth during sleep (24%)”. The last sleep-related

characteristic problematic to the parents of the children with PDD and sleep problems was "child is not ready to go to bed at bedtime (31%)".

In contrast, the sleep-wake characteristics viewed as problematic to the parents of the children with PDD but without sleep problems were much less. Only two characteristics related to morning waking were reported by one fourth of the parents, which included "child has difficulty getting out of bed in the morning (25%)" and "child seems tired (25%)". Table 7 presents the sleep-wake characteristics and/or problems that were commonly reported and considered problematic by the parents of the children with PDD in this study, based on the results of the CSHQ.

Table 7.

Problematic Sleep-Wake Characteristics Commonly Reported

Group	Lists of characteristics
Children with sleep problems (n = 29)	Waking during the night: -Child awakes once during the night. -Child awakes more than once during the night. -Child needs help for returning to sleep after waking. Morning waking: -Child seems tired. -Child wakes up very early in the morning. -Child does not have a good appetite in the morning. -Child has difficulty getting out of bed in the morning. Sleep behaviors: -Child has trouble sleeping away from home. -Child does not sleep about the same amount each day. -Child moves to someone else's bed during the night. -Child grinds teeth during sleep. Around bedtime: -Child is not ready to go to bed at bedtime
Children without sleep problems (n = 20)	Morning waking: -Child has difficulty getting out of bed in the morning. -Child seems tired.

In addition to determining whether or not the sleep-related characteristics were problematic to the caregivers, the study used the CSHQ to ask the caregivers to recall the

frequency of the occurrence of sleep-related characteristics during the most recent typical week. A higher score in each statement is indicative of a higher frequency of the sleep-related characteristics. That is, a score of 3 indicates the targeted behavior usually occurs (5 to 7 days per week); a score of 2 means the targeted behavior sometimes occurs (2 to 4 days per week); and, a score of 1 refers the targeted behavior rarely occurs (0 to1 day per week), respectively.

The results showed that the children with PDD and sleep problems had slightly higher average scores across the 33 different items in the CSHQ although the averages of the two groups of children were all within the same 3-point Likert scale. In contrast, the children with PDD but without sleep problems showed slightly higher averages in the following behaviors: child falls asleep in parent(s)'/sibling(s)' bed; child is afraid of sleeping in the dark; child wets the bed at night; child snorts and/or gasps during sleep; child wakes up by him/herself; adults or siblings wake up child; child has difficulty getting out of bed in the morning; child takes a long time to become alert in the morning; child needs special objects to fall asleep; child has a good appetite in the morning; and, child wakes up with an alarm clock.

The data about the usual amount of children's sleep time, including nocturnal sleep and daytime naps showed that, the group of children with PDD and sleep problems had an average of 9 hours and 11 minutes. The group with PDD but without sleep problems had an average of 10 hours and 52 minutes. The data concerning night waking time of the children with PPD, showed a big difference between the group with sleep problems and those without sleep problems. Among the 29 children with PDD and sleep problems, nine woke up less than 10 minutes; the rest woke up longer than 10 minutes during their nocturnal sleep. Additionally, 11 of the children with PDD and sleep problems were up for at least one hour or more up to four hours at night before falling back to sleep. Instead, the night waking time of the children group with PDD but without sleep problems indicated that all but one child were awake less than 10 minutes. The

waking time of the exceptional single child in the group without sleep problems was 45 minutes.

Interplay between Children's and Caregivers' Sleep and Other Variables

The Pittsburgh Sleep Quality Index (PSQI) was utilized in the current study to examine the sleep of the caregiver participants. The Total Score of the PSQI indicates the sleep quality. The results of the present study showed that more caregivers of the children with PDD and sleep problems had poor sleep quality, in comparison to caregivers of the children with PDD but without sleep problems. The sleep quality was poor among 21 of the 29 caregivers of the children with PDD and sleep problems. Still, half of the caregivers of the children with PDD but without sleep problems had poor sleep quality although their sleep quality, generally speaking, was better than that of the caregivers of children with PDD and sleep problems. Additionally, the caregivers of the children with PDD and sleep problems had a slightly lower average of sleep efficiency than those of the children with PDD but without sleep problems (86.38% vs. 90.65%).

To examine the relationship between the sleep of the children and the caregivers, two separate correlation tests were conducted. First, all of the children's CSHQ scores (n = 49), whether they had sleep problems or not, and all of the caregivers' PSQI scores were compared. At the same time, the eight subscales of the CSHQ were tested to determine whether any two subscales were significantly correlated. Second, comparisons were made individually within the two groups of children (those with PDD and sleep problems: n = 29; those with PDD but without sleep problems: n = 20) and their caregivers, accordingly.

The results of the first correlation test indicated that the children's Total Scores from the CSHQ and caregivers' sleep quality index (i.e., PSQI Total Scores) were significantly correlated (Pearson correlation r = .466, $p < .01$). As well, the Subscale 2 score (Sleep Onset Delay) from the CSHQ in children was significantly correlated with

the caregivers' sleep quality (Pearson correlation $r = .340$, $p < .05$). On the other hand, within the eight Subscales of the CSHQ, the results showed that Subscales 1 (Bedtime Resistance) and 2 (Sleep Onset Delay), Subscales 1 (Bedtime Resistance) and 4 (Sleep Anxiety), Subscales 2 (Sleep Onset Delay) and 3 (Sleep Duration), Subscales 2 (Sleep Onset Delay) and 4 (Sleep Anxiety), Subscales 5 (Night Wakings) and 6 (Parasomnias), and Subscales 4 (Sleep Anxiety) and 8 (Daytime Sleepiness) were significantly correlated. Appendix F presents the results of the Pearson Correlation statistics in details.

Next, separate comparisons were made between children with PDD and sleep problems and their caregivers, and between children with PDD but without sleep problems and their caregivers. The results showed that significant correlations existed among several pairs of the CSHQ Subscales within the group of children with PDD and sleep problems. Also, the CSHQ Total Scores of the group of children with PDD and sleep problems were correlated significantly with their caregivers' PSQI Total Score ($r = .504$, $p < .001$). In contrast, the CSHQ Total Scores of the children with PDD but without sleep problems were not correlated significantly with their caregivers' PSQI Total Scores. In addition, only a few pairs of the subscales of the CSHQ in the group of children without sleep problems were significantly correlated. The results of the correlation tests are presented in the Appendix G.

Furthermore, the present study included an analysis of factors that could be used to predict whether the children were having or not having sleep problems. The evaluated factors included children's age, diagnosis, comorbidity, and medication use. To complete the analyses, the unadjusted odds ratios (OR) were tested for each predictor to determine its ability to independently predict the children's sleep status (i.e., having or not having sleep problems based on their primary caregivers' reports). For continuous variables, logistic regression was performed. For nominal or categorical variables with two levels, unadjusted ORs were evaluated by using the 2x2 cross tabulation procedure. In addition,

the separate logistic regression analyses were run using the Total Scores of the CSHQ and the PSQI to determine their significance of predicting the children's sleep status.

The results indicated that the diagnosis of the children (PDD vs. AS or PDD-NOS) was a significant predictor to whether the child had or did not have sleep problems. A child was 3.84 times more like to have sleep problems if he/she was diagnosed with PDD versus AS or PDD-NOS. In contrast, children's age, comorbidity, and medication use were not significant predictors for whether children had or did not have sleep problems. The separate analyses of logistic regression showed that the Total Scores of the CSHQ and PSQI were significant predictors of the children's sleep. The higher a Total Score from the CSHQ a child had, or the higher a Total Score from the PSQI the primary caregiver had, the more likely the primary caregiver would report the child had sleep problems.

Furthermore, standard logistical regression was performed to assess the impact of factors on the likelihood that a child may be reported to have sleep problems. The model contained four predictor variables: (a) diagnosis with PDD versus AS or PDDNOS, (b) being medicated versus not medicated, (c) having comorbidities versus not, and (d) age at the beginning of study participation. The full model containing all the predictors was statistically significant, $\chi 2$ (4, N = 49) = 11.44, $p < .05$, indicating that overall the model was able to distinguish between the children who were reported to have sleep problems and those who were reported to have no sleep problems. The Hosmer-Lemeshow test further supported the predictive nature of the model. The model as a whole explained between 21% (Cox and Snell R square) and 28% (Nagelkerke R squared) of the variance in the children's sleep problems. As shown in the following logistic regression table (see Table 8), only one of the independent variables, the PDD diagnosis of the child, contributed significantly to this model (odds ratio = 4.942). This indicated that with all other predictors in the model constant, a child is 4.942 times more like to have sleep problems if he/she was diagnosed with PDD than with AS or PDD-NOS.

Table 8.

Factors that Impact Children with PDD to Have Sleep Problems (N = 49)

Study Variables	b	SE	Adjusted Odds	Ratio 95% C.I.
Age	-.150	.123	.861	(0.677, 1.095)
Diagnosis	-1.598	.698	4.942*	(1.257, 19.424)
Comorbidity	-1.189	.723	.305	(0.074, 1.257)
Medication	-.855	.713	.425	(0.105, 1.720)

Note. * Statistical Significance = ($p < .05$). Model (likelihood ratio) $\chi 2$ (4, N = 49) = 11.44, $p < .05$

Children's Sleep, Sleep-Related Characteristics, and Daytime Behaviors

To examine the relationship between children's sleep and daytime behaviors, this study analyzed the data gleaned from the sleep diaries and problem behaviors checklists. The 14-day sleep diaries showed that both groups of the 41 children with PDD (PDD & sleep problems *n* = 22; PDD but no sleep problems *n* = 19) had very infrequent intake of caffeinated drinks during the two-week recordings for the study. Only two or less of the children were reported to have consumed caffeinated drinks on some of the recording days. Similarly, both groups of the children with PDD seldom napped during daytime. Those who did nap tended to be younger than five years old. Additionally, both groups of children had no significant differences in their indoor and outdoor playtime.

In the 14-day sleep diaries, the caregivers also reported what activities their children had one hour before bedtime. The results showed that the children with PDD and sleep problems were more likely to watch TV or DVD, to play computer or video games, or to use computer than those with PDD but without sleep problems. Furthermore, the children with PDD and sleep problems had an increasing pattern of watching TV/DVD, and/or computer use/video game playing on both Fridays and weekends. In contrast, there were less children in the group having no sleep problems who watched TV/DVD, used computer or played video games before bedtime. Even on Fridays and weekends, the children with PDD but without sleep problems did not show an increasing trend of using electronics before bedtime. The following Table presents the numbers of children

who watched TV or DVD, played computer or video games, or used computer right before their bedtime during the two-week recordings in the present study.

Table 9.

TV/DVD Watching, ComputerUse/Video Game Playing Before Bedtime

Group Date	Children with Sleep Problems (n = 22)	Children without Sleep Problems (n = 19)
Week 1		
Saturday	11 (50%)	5 (26%)
Sunday	10 (45%)	5 (26%)
Monday	9 (41%)	3 (16%)
Tuesday	9 (41%)	2 (11%)
Wednesday	7 (32%)	4 (21%)
Thursday	7 (32%)	4 (21%)
Friday	11 (50%)	4 (21%)
Week 2		
Saturday	11 (50%)	4 (21%)
Sunday	7 (32%)	6 (32%)
Monday	8 (36%)	2 (11%)
Tuesday	7 (32%)	7 (37%)
Wednesday	7 (32%)	1 (5%)
Thursday	6 (27%)	2 (11%)
Friday	10 (50%)	5 (26%)

To test the relationship between sleep and behaviors of the children with PDD, this study used data from the 10-day problem behaviors checklists and the 10 out of 14-day sleep diaries. Because information regarding the intensity of behaviors was frequently uncompleted, this study used only information about the frequency/duration of behaviors reported/recorded on the problem behaviors checklists. On the other hand, this study used the overall sleep rating (i.e., refreshed, somewhat refreshed, or fatigued) from the sleep diaries, to examine whether a night of refreshed, somewhat refreshed, or fatigued sleep would cause a day of decreased, non-changed, or increased problem behaviors. The results of chi-square tests did not show any significant association between the overall sleep and daytime problem behaviors of the children with PDD in this study.

However, descriptive data from the problem behaviors checklists and sleep diaries, indicated that when children with PDD were ill, for example, had a cold or a fever, vomiting, or food intolerance there were negative impacts on the children's sleep quality and quantity as well as behaviors during both daytime and nighttime. In addition, bedwetting, anxiety about an upcoming sports game or a test the next day, uncomfortable room temperature, body jerking, or snoring had negative impacts on the sleep of the children as perceived by the primary caregivers.

Summary. The children with PDD and sleep problem in this study were found to have more comorbidities, more medication use, more night wakings, more parasomnias, longer sleep onset delay (i.e., longer sleep latency), longer total night waking time, as well as shorter sleep duration than children with PDD but without sleep problems. As expected, the number of sleep-wake characteristics problematic to the caregivers of the children with PDD and sleep problems was greater than in the comparison group in this study. Also, the children with PDD and sleep problems in this study had a more typical PDD diagnosis (in contrast to AD or PDD-NOS diagnosis), more comorbidities, and more medication use than those with PDD but without sleep problems. Additionally, the results showed that diagnosis with PDD versus AS or PDD-NOS, being medicated versus not medicated, having comorbidities versus not, and age at the beginning of participation in the study were factors to be used for distinguishing between the children who were reported to have sleep problems and those who were reported to have no sleep problems. This dissertation reported detailed contextual information that has often been neglected in earlier research. The results examining the relationship between nighttime sleep and daytime problem behaviors did not show a strong association between them, although the literature has supported the significant interactions between sleep and behaviors. Interpretations of the results from this dissertation study and relevant discussion are presented in the next chapter.

CHAPTER V: DISCUSSION

This chapter discusses the results of the present study in the context of findings from previous studies. The implications for practice and research are discussed. Limitations of the present study and recommendations for future research are highlighted.

The main purpose of this dissertation study was to use information collected through survey methodology to describe the sleep-wake characteristics and sleep problems of the children with pervasive developmental disorders (PDD), and the relationships among the children's sleep and behaviors, caregivers' sleep, and other important contextual variables. In addition, this study had the following objectives: (a) to explore a wide range of the sleep-wake characteristics and problems of children with PDD by using the well-developed and commonly-used instruments in the literature, (b) to replicate the application of regression analyses to examine the relationship between sleep and the variables pertaining to children with PDD, and (c) to closely understand how daytime behaviors and sleep of children with PDD interact with each other, by using the data of two-week recordings of overall nighttime sleep and daytime problem behaviors.

The targeted participants of this study included the children with PDD and their primary caregivers. This study mainly required the caregiver participants (and teachers/therapists) to fill three questionnaires, one sleep diary, and one checklist over the 2-week study participation. A total of 49 children with PDD for the first part of the study (29 were having sleep problems, and 20 were not), of 41 children with PDD for the second part of the study (22 were having sleep problems, and 19 were not), and their primary caregivers participated in this study.

As anticipated, several differences of sleep-wake characteristics and sleep problems were found between the two participating groups of children (i.e., children with PDD and sleep problems vs. children with PDD but without sleep problems) in this study. The differences included but were not limited to the diagnosis of PDD, comorbidities,

medication use, bedtime and wake up time, the Total and Subscale Scores of the Children's Sleep Habits Questionnaire (CSHQ), total sleep time, total night waking time, and activities before bedtime. The results of the CSHQ data analyses indicated that the children with PDD and sleep problems had more problematic behaviors or habits related to sleep onset delay, sleep duration, night wakings, and parasomnias than those with PDD but without sleep problems.

Notably, 17 of the 20 children whose parents reported not having sleep problems in this study had Total Scores from the CSHQ above the cutoff; this implied that their children's sleep falls into clinical range, and further sleep evaluations are needed. Perhaps the primary caregivers of those children with PDD were less concerned about nocturnal behaviors and sleep problems than about the daytime learning and behaviors of their children. When caregivers do not think that their children have any sleep problems, they are less likely to pay attention to and report their child's sleep problems during conversations or meetings with professionals or service providers. Therefore, it becomes critical to investigate when and how professionals should recommend good sleep practices to caregivers of children with PDD, even when caregivers are not aware of the existing sleep problems of their children.

On the other hand, several studies theorized that a higher prevalence of sleep problems in children with PDD may be due to families of children with PDD over reporting, in comparison to other clinical or typically developing groups (e.g., Hering et al., 1999). Instead, the caregivers in the present study seemed to show a tendency to under report sleep problems of the children with PDD if the scores of the CSHQ were used to determine if a child has sleep problems or not. Applying objective and subjective measurements of sleep and comparing the differences would determine whether parental reports of sleep problems correspond to physiological measures of sleep in their children. However, this is rarely done because the concern of the parents of children with special needs is usually the key element that initiates an intervention. If parents under report their

children's sleep problems, then interventions about sleep problems are not prioritized as they should be.

The sleep of the children with PDD and sleep problems and the sleep of their caregivers were significantly correlated. In contrast, sleep was not significantly correlated between the children without sleep problems and their caregivers in this study. In addition, the Total Scores of the CSHQ and the PSQI were found to be significant predictors of sleep problems in children. These findings are consistent with research suggesting that caregivers of children with PDD and sleep problems are likely to have sleep problems (Hoffman et al., 2008; Quine, 1991; Richdale et al., 2000).

Interestingly, eight primary caregivers of the children with PDD and sleep problems in this study had good sleep quality; and half of the caregivers of the children without sleep problems had poor sleep quality. Given the association of children's and primary caregivers' sleep, it would be vital to examine how caregivers' sleep would influence their perspectives about sleep and their practices regarding their children's sleep. Understanding the positive characteristics of "good-sleeper" primary caregivers of the children with PDD and sleep problems would help identify resources for coping with PDD.

In addition, TV/DVD watching, and/or computer use/video game playing were more common in the group of children having sleep problems than in the group that did not have sleep problems. This may imply that the caregivers of children with sleep problems had poorer practices of sleep hygiene for their children than did the comparison group in this study. This could result from the fatigue of caregivers of children with PDD. Or, caregivers probably do not know the importance of good sleep practices or sleep hygiene, and its impact on the overall behaviors and learning in children.

Furthermore, off-routine activities have a negative impact on the sleep of children, especially children with PDD (Richdale & Prior, 1995). The children with sleep problems in this study had more irregular bedtimes and wake up times between weekdays

and weekends. This study was not able to conclude that this behavior was caused by the nature of the sleep of the children, the sleep practices of the caregivers, or both. However, the caregivers of the children with PDD and sleep problems in this study stated that, one of the reasons for their children having sleep problems was the lack of strict sleep schedule/bedtime routines, in conjunction with more television watching, computer use or video game playing within one-hour before bedtime in the children with sleep problems than those without sleep problem. The findings of the present study imply that sleep problems of children with PDD do not solely result from the disabilities of the children. Some of the sleep problems possibly result from learned behaviors (e.g., how primary caregivers respond to their children's sleep-related behaviors) and poor environmental factors (e.g., how primary caregivers implement practices that promote sound sleep into daily bedtime routines or rituals for their children).

The results of the regression analyses showed that the CSHQ is able to detect whether a child with PDD participating in this study had sleep problems or not, from the perspective of their primary caregivers. This indicates the usefulness of the CSHQ as a screening questionnaire in children with PDD. Lastly, family members of the children with PDD, regardless of their children's sleep, tended to have sleep-related problems in this study. This may imply a need for education about and evaluation of sleep for all family members of children with PDD if appropriate.

Implications for Practice

Sleep composes a significant portion of an infant's and a young child's life on a daily basis. Professionals, especially pediatricians who do well-child checkups, should provide education about, and emphasize the importance of common practices that promote good sleep in children to *all* parents of children who start to show sleep disturbances.

Other professionals who provide direct services to children with PDD should take children's sleep into consideration on a daily basis in order to get better service outcomes. At the same time, educating parents about the PDD diagnosis and comorbidities of children, and their impact on children's sleep and behaviors is equally important. Regardless of the sleep status of children with PDD, professionals should offer verbal and written instructions to all caregivers of children with PDD.

In a special education setting, arranging a library-like area, tucked in a corner of a classroom, that is decorated with one or two soft beanbag chairs, some stuffed animals and blankets, and equipped with a music player, would be beneficial for children with PDD and sleep problems. This area could be used for quiet reading, for calming down/self soothing, or even for a short nap. The benefits of brief naps (i.e., 10-15 minutes) after lunchtime have been reported in the literature (Brooks & Lack, 2006; Takahashi, Fukuda, & Arito, 1998). In most Asian countries, schools (kindergarten to 12th grade) require all students to take a 30-45 minute nap after their lunch. It is hard to implement this kind of schedule in the public schools in the United States, mainly due to the geographic differences and the related school bus services. So, a flexible space for individual students who may benefit from a brief nap is a good alternative. Improving the overall wellbeing of the children is essential to have good learning outcomes and preventing problem behaviors (Sigafoos et al., 2003). Thus, educators should not overlook the "power" of a naptime for a student with sleep problems.

Finally, given that the sleep quality of the primary caregivers of the children with PDD in this study was poor overall, respite care for families of children with PDD should be addressed in order to decrease the burnout from being primary caregivers of children with PDD. Out of necessity, parents of children with PDD take on more roles such as behavior managers, education and policy advocates, and nutritionists at home than do parents of children with typical development. It is important to have respite care services available to families of children with PDD. If respite care were available, then primary

caregivers of children with PDD would be able to get enough rest and continue providing good care around the clock not only to the children with special needs but also to other family members.

Limitations

Several limitations of this study must be considered when interpreting these results. First, as with any survey study, the data were self-reported, thereby impacting the data reliability and credibility. In particular, the two-week recordings of sleep and behaviors of the children with PDD were lacking inter-rater reliability because the study methodology relied solely on the reports of the primary caregivers (and teachers/therapists) of the children with PDD.

Furthermore, the study sample was small and not randomly selected, in comparison to a large-scale study with a community-based sample. Thus, the results in this study may not be representative of the norm of children with PDD and their caregivers. To increase the power of the generalization of the results, a larger sample size is essential. One option for increasing the size of the sample in a study where participants are required to make a commitment over two weeks is to provide greater incentives to the participants than what was offered in the present study. In contrast, conducting qualitative studies in a small sample size of participants would be ideal for researchers who have limited resources to recruit a large sample of participants.

Another limitation in this study was that it measured the daytime behaviors of the children without the design of a definitive condition guideline (e.g., on-task or free play time), of a consistent time period in each day across children participants, and of the inter-rater checks. These limitations could be one of the reasons that the relationship between the sleep and behaviors of the children with PDD in this study was not found significantly correlated. Videotaping of daytime behaviors under the same condition, at the same time period, and by at least two raters may be one of the solutions. A recently

published study of Anders and colleagues (2012) examined sleep, sleepiness, and daytime performance in three groups of children, including children with autism, intellectual disability, and typical development. They adopted the Psychoeducational Profile-Revised (Schopler, Reichler, Bashford, Lansing, & Marcus, 1990) and the Bayley peg-board task (Beyley, 1969) to measure daytime functioning of the children participants. Having children perform fixed tasks and recording their performances may eliminate the drawbacks of asking parents or therapists/teachers to report a wide range of daytime problem behaviors.

Recommendations for Future Research

Despite the aforementioned drawbacks, this dissertation study highlights several areas that warrant further investigation. First, the sleep hygiene or practices by the parents of children with PDD should get close examination. From the perspective of prevention, sleep hygiene can promote good sleep in everyone in the whole family. On the other hand, all sleep related interventions, whether behavioral, pharmaceutical, or both require solid practices of sleep hygiene every day, including weekends. Therefore, it would be essential to understand the practices of sleep hygiene by caregivers of children with PDD and the impact of sleep hygiene on the sleep of both caregivers and children.

In addition, the sleep quality of parents of children with PDD and how it impacts their beliefs and daily sleep practices should be addressed. The development of critical skills or positive behaviors such as self helping, eating, toilet training, promoting a child‘s good sleep and treating a child’s sleep problems mainly depends upon parents’, especially mothers’, implementations. It would be equally critical to examine the sleep beliefs and practices of primary caregivers of children with PDD and sleep problems who have poor sleep as well as who have good sleep.

Compared to some issues, sleep research in the field of PDD is still in its infancy. This dissertation study adds to the literature an important replication of earlier research

and an exploration of issues to further understand the sleep-wake characteristics and sleep problems of children with PDD. It could indirectly contribute to better prevention and the development of practical and effective plans to address sleep not only in children with PDD but in their primary caregivers and other family members.

APPENDICES

APPENDIX A:

(Abbreviated) Pediatric Sleep Clinic Questionnaire

1. Name of Child: _____ 2. Date of Birth: ___/___/___
3. Name of person (i.e., **primary caregiver**) completing questionnaire_____
   Relationship to child _____

4. Do you think your child has sleep problems? ☐ Yes ☐ No
If YES, do you have any major concerns about your child's sleep?
(If not, please skip #5 & #6.)
_____
_____
_____
_____
_____

5. What do you think is causing your child's sleep problem? _____
_____
_____
_____
_____

6. When did your child's sleep problems start? _____
_____

FAMILY INFORMATION

7. Primary Caregiver's Marital Status: Married Divorced Separated Widowed Single
   If divorced, child custody with: _____
8. Primary Caregiver's education: _____
9. Primary Caregiver's occupation: _____

Work outside of home? yes no
If yes, circle each label that best describes her work:

day shift	full time
evening shift	part time
night/graveyard shift	one job
changing shifts	more than one job

10. What best describes your child's racial/ethnic background?

____ Asian/Asian American
____ Black/African American
____ Hispanic/Latino
____ White/Caucasian
____ Multiracial (Please specify) _____
____ Other (Please specify) _____

11. Please list family members (parents, grandparents, siblings, aunts/uncles) with a history of any SLEEP PROBLEMS (including: loud snoring/obstructive sleep apnea, excessive sleepiness/ narcolepsy, restless legs/periodic leg movements, insomnia, other sleep problems).

Family Member	Type of Sleep Problem
_____	_____
_____	_____
_____	_____
_____	_____

SLEEP HISTORY (GENERAL)

12. What time does your child usually go to bed on school nights (**weekdays**)? _____

Range: _____ am/pm to _____am/pm

13. What is the main reason your child goes to bed at a particular time? (Check one below)

_____ a. Because it fits best with the family's schedule
_____ b. Because she/he feels sleepy then
_____ c. Because that is when her/his TV shows are over
_____ d. Because that is when her/his brothers and sisters go to bed
_____ e. To "get enough sleep" for the following day's activities
_____ f. Other (describe briefly) _____

14. What time does your child usually wake up on school day/**weekday** mornings? ____

Range: _____ am/pm to _____am/pm

15. What usually wakes up your child in the morning on school days/**weekdays**? (Check one below)

_____ a. Alarm clock
_____ b. Parent or other family member
_____ c. Noise
_____ d. Needs to use the bathroom
_____ e. Spontaneous
_____ f. Other (describe briefly):

16. Which of the following applies to waking your child in the morning on school days/**weekdays**? (Check one below)

_____ a. I almost always have great difficulty getting him/her out of bed
_____ b. I sometimes have great difficulty getting him/her our of bed
_____ c. I seldom have great difficulty getting him/her out of bed
_____ d. I never have great difficulty getting him/her out of bed

17. What times does your child usually go to bed on **weekend** nights? _____

Range: _____ am/pm to _____am/pm

18. What time does your child usually wake up on **weekend** mornings? _____

Range: _____ am/pm to _____am/pm

19. What usually wakes up your child in the morning on **weekends**? (Check one below)

_____ a. Alarm clock
_____ b. Parent or other family member
_____ c. Noise
_____ d. Needs to use the bathroom
_____ e. Spontaneous
_____ f. Other (describe briefly):

20. Which of the following applies to waking your child in the morning on **weekends**? (Check one below)

_____ a. I almost always have great difficulty getting him/her out of bed
_____ b. I sometimes have great difficulty getting him/her our of bed
_____ c. I seldom have great difficulty getting him/her out of bed
_____ d. I never have great difficulty getting him/her out of bed

21. List any prescription, over-the counter medications, and herbals or "natural" remedies your child currently (within the past month) uses:

Name: _____ How frequently used: _____

Reason for using it: _____

Name: _____ How frequently used: _____

Reason for using it: _____

Name: _____ How frequently used: _____

Reason for using it: _____

Name: _____ How frequently used: _____

Reason for using it: _____

Name: _____ How frequently used: _____

Reason for using it: _____

Name: _____ How frequently used: _____

Reason for using it: _____

MEDICAL HISTORY:

22. Were there any problems with this pregnancy or delivery (prematurity, high blood pressure, etc.)?

_____

_____

23. What was the birth weight? _____

24. Does your child have allergies? Yes ☐ No ☐ Possibly ☐

In the **past year**....

a. How many days has your child missed school due to asthma? _____ None ☐
b. How many days has your child been hospitalized for asthma? _____ None ☐
c. List any medications your child takes for asthma:

Type: _____Frequency: _____
Type: _____Frequency: _____
Type: _____Frequency: _____

25. Does your child frequently complain of heartburn? Yes ☐ No ☐ Don't know ☐

Has he/she ever been diagnosed with gastroesophageal (stomach) reflux?

Yes ☐ No ☐ Only when younger ☐

26. Do you have additional comments about your child's medical history? (Continue on additional sheets if necessary.)

_____

_____

HEALTH HABITS – Please answer the following questions regarding health habits which may impact on sleep. In the past 2 weeks, on average:

27. How much caffeinated soda did you child drink?

☐ More than 3 glasses per day ☐ Between 1 and 3 glasses per day
☐ Less than 1 glass per day ☐ None ☐ Don't know

28. Did your child watch TV and/or videos in the 30 minutes before falling asleep?

☐ Every night ☐ 5-6 nights ☐ 3-4 nights ☐ 1-2 nights ☐ Not at all

29. Does you child have a television set in his/her bedroom?

☐ Yes ☐ No

DEVELOPMENTAL HISTORY – PART A

30. In what grade is your child currently enrolled? _____ grade

31. What school does your child attend this year? _____

32. Besides autism spectrum disorders (ASD) or pervasive developmental disorders (PDD), has your child been also diagnosed with:

	YES	NO	COMMENTS
a. dyslexia	☐	☐	_____
b. a speech impairment	☐	☐	_____
c. mental retardation	☐	☐	_____
d. a behavior disorder	☐	☐	_____
e. attention deficit disorder	☐	☐	_____
f. other learning disorder (please specify)	☐	☐	_____

33. Is your child enrolled in any special education (special needs) classes in school?

☐ Yes ☐ No
Please describe:_____

34. Does your child have an Individualized Education Plan (I.E.P.) provided by the school?

☐ Yes ☐ No
If yes, for what reason: _____

35. Generally, how often does your child attend school?
a. ☐ Every day
b. ☐ 3-4 days per week
c. ☐ 1-2 days per week
d. ☐ Less than once per week

36. Generally, how often is your child late for school?
a. ☐ Every day
b. ☐ 3-4 days per week
c. ☐ 1-2 days per week
d. ☐ Less than once per week

DEVELOPMENTAL HISTORY – PART B

37. Does your child have any significant behavioral or mental health problems?

☐ Yes ☐ No
If yes, please describe: _____

38. Has your child ever received counseling for behavioral or mental health problems?

☐ Yes ☐ No
If yes, for what reason: _____

39. Have you or your spouse ever been seen by a mental health counselor for concerns regarding your child?

☐ Yes ☐ No
If yes, for what reason: _____

40. To what organized groups does your child currently belong? (e.g., team sports, scouts, church, groups, etc.)

_____

SLEEP BELIEFS

41. In order to better understand your sense of the average child's sleep, please answer the following questions based on your beliefs for an <u>average</u> child (your child's age) who does not have sleep problems?

a. How many hours of sleep per night does the average child NEED? _____ hours

b. How many hours of sleep per night does the average child GET? _____ hours

c. How long does it take the average child to get to sleep? _____ minutes

d. How many times does the average child wake up during the night? _____ times

e. How long does the average child spend awake in bed during the night?

_____ minutes *OR* _____ hours

f. Do you think most child get enough sleep? ☐ Yes ☐ No ☐ Don't know

THANK YOU VERY MUCH FOR YOUR TIME!

APPENDIX B:

Children's Sleep Habits Questionnaire

The following statements are about your child's sleep habits and possible difficulties with sleep. Think about the past week in your child's life when answering the questions. If last week was unusual for a specific reason (such as your child had an ear infection and did not sleep well or the TV set was broken), choose the most recent typical week. Answer USUALLY if something occurs **5 or more times** in a week; answer SOMETIMES if it occurs **2-4 times** in a week; answer RARELY if something occurs **never or 1 time** during a week. Also, please indicate whether or not the sleep habit is a problem by circling "Yes," "No," or "Not applicable (N/A).

Bedtime

Write in child's bedtime: _____

	3 Usually (5-7)	2 Sometimes (2-4)	1 Rarely (0-1)	Problem?		
Child goes to bed at the same time at night	☐	☐	☐	Yes	No	N/A
Child falls asleep within 20 minutes after going to bed	☐	☐	☐	Yes	No	N/A
Child falls asleep alone in own bed	☐	☐	☐	Yes	No	N/A
Child falls asleep in parent's or sibling's bed	☐	☐	☐	Yes	No	N/A
Child falls asleep with rocking or rhythmic movements	☐	☐	☐	Yes	No	N/A
Child needs special object to fall asleep (doll, special blanket, etc.)	☐	☐	☐	Yes	No	N/A
Child needs parent in the room to fall asleep	☐	☐	☐	Yes	No	N/A
Child is ready to go to bed at bedtime	☐	☐	☐	Yes	No	N/A
Child resists going to bed at bedtime	☐	☐	☐	Yes	No	N/A
Child struggles at bedtime (cries, refuses to stay in bed, etc.)	☐	☐	☐	Yes	No	N/A
Child is afraid of sleeping in the dark	☐	☐	☐	Yes	No	N/A
Child is afraid of sleep alone	☐	☐	☐	Yes	No	N/A

Sleep Behavior

Child's usual amount of sleep each day: _____ hours and _____ minutes
(combining nighttime sleep and naps)

	3 Usually (5-7)	2 Sometimes (2-4)	1 Rarely (0-1)	Problem?		
Child sleeps too little	☐	☐	☐	Yes	No	N/A
Child sleeps too much	☐	☐	☐	Yes	No	N/A
Child sleeps the right amount	☐	☐	☐	Yes	No	N/A
Child sleeps about the same amount each day	☐	☐	☐	Yes	No	N/A
Child wets the bed at night	☐	☐	☐	Yes	No	N/A
Child talks during sleep	☐	☐	☐	Yes	No	N/A
Child is restless and moves a lot during sleep	☐	☐	☐	Yes	No	N/A
Child sleepwalks during the night	☐	☐	☐	Yes	No	N/A
Child moves to someone else's bed during the night (parent, brother, sister, etc.)	☐	☐	☐	Yes	No	N/A

Sleep Behavior (continued)

	3 Usually (5-7)	2 Sometimes (2-4)	1 Rarely (0-1)	Problem?		
Child reports body pains during sleep. If so, where?	☐	☐	☐	Yes	No	N/A
_____						
Child grinds teeth during sleep (your dentist may have told you this)	☐	☐	☐	Yes	No	N/A
Child snores loudly	☐	☐	☐	Yes	No	N/A
Child seems to stop breathing during sleep	☐	☐	☐	Yes	No	N/A
Child snorts and/or gasps during sleep	☐	☐	☐	Yes	No	N/A
Child has trouble sleeping away from home (visiting relatives, vacation)	☐	☐	☐	Yes	No	N/A
Child complains about problems sleeping	☐	☐	☐	Yes	No	N/A
Child awakens during night screaming, sweating, and inconsolable	☐	☐	☐	Yes	No	N/A
Child awakens alarmed by a frightening dream	☐	☐	☐	Yes	No	N/A

Waking During the Night

	3 Usually (5-7)	2 Sometimes (2-4)	1 Rarely (0-1)	Problem?		
Child awakes once during the night	☐	☐	☐	Yes	No	N/A
Child awakes more than once during the night	☐	☐	☐	Yes	No	N/A
Child returns to sleep without help after waking	☐	☐	☐	Yes	No	N/A

Write the number of minutes a night waking usually lasts: _____

Morning Waking

Write in the time of day child usually wakes in the morning: _____

	3 Usually (5-7)	2 Sometimes (2-4)	1 Rarely (0-1)	Problem?		
Child wakes up by him/herself	☐	☐	☐	Yes	No	N/A
Child wakes up with alarm clock	☐	☐	☐	Yes	No	N/A
Child wakes up in negative mood	☐	☐	☐	Yes	No	N/A
Adults or siblings wake up child	☐	☐	☐	Yes	No	N/A
Child has difficulty getting out of bed in the morning	☐	☐	☐	Yes	No	N/A
Child takes a long time to become alert in the morning	☐	☐	☐	Yes	No	N/A
Child wakes up very early in the morning	☐	☐	☐	Yes	No	N/A
Child has a good appetite in the morning	☐	☐	☐	Yes	No	N/A

Daytime Sleepiness

	3 Usually (5-7)	2 Sometimes (2-4)	1 Rarely (0-1)	Problem?		
Child naps during the day	☐	☐	☐	Yes	No	N/A
Child suddenly falls asleep in the middle of active behavior	☐	☐	☐	Yes	No	N/A
Child seems tired	☐	☐	☐	Yes	No	N/A

During the past week, your child has appeared very sleepy or fallen asleep during the following (check all that apply):

	1 Not Sleepy	2 Very Sleepy	3 Falls Asleep
Play alone	☐	☐	☐
Watching TV	☐	☐	☐
Riding in car	☐	☐	☐
Eating meals	☐	☐	☐

APPENDIX C:

Pittsburgh Sleep Quality Index

Instructions: The following questions relate to your usual sleep habits during the past week only. Your answers should indicate the most accurate reply for the majority of days and nights in the past week. Please answer all questions. During the past week:

1. When have you usually gone to bed? _____
2. How long (in minutes) has it taken you to fall asleep each night? _____
3. When have you usually gotten up in the morning? _____
4. How many hours of actual sleep do you get at night? (This may be different than the number of hours you spend in bed) _____

During the past week, how often have you had trouble sleeping because you…	Not during the past week	Less than once a week	Once or twice a week	Three or more a week
a. Cannot get to sleep within 30 minutes				
b. Wake up in the middle of the night or early morning				
c. Have to get up to use the bathroom				
d. Cannot breathe comfortably				
e. Cough or snore loudly				
f. Feel too cold				
g. Feel too hot				
h. Have bad dreams				
i. Have pain				
j. Other reason(s), please describe, including how often you have had trouble sleeping because of this reason(s):				
During the past week, how often have you taken medicine (prescribed or "over the counter") to help you sleep?				
During the past week, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?				
During the past week, how much of a problem has it been for you to keep up enthusiasm to get things done?				
	Very good	Fairly good	Fairly bad	Very bad
During the past week, how would you rate your sleep quality overall?				

APPENDIX D:

Sleep Diary

Day _____ Date _____ Child's name: _____

Please complete this part at the end of day

- My Child consumed caffeinated drinks (e.g., coffee, tea, cola) in the:
  ☐ Morning ☐ Afternoon ☐ Within several hours before going to bed
  ☐ Not applicable

- Medication(s) my child took during the day (please list name of medication/drug):

- About 1 hour before my child went to sleep, my child did the following activity (e.g., doing homework, watch TV, read):

- My child took a nap/naps during daytime between (time period):

Please complete this part in morning

- Last night, my child went to bed at _____

- This morning, my child got out of bed at _____

- Last night, my child fell asleep in about _____ minutes

- My child woke up during the night (record number of times): _____ times

- When my child woke up for the day, I noticed my child felt (check one):
  ☐ Refreshed ☐ Somewhat refreshed ☐ Fatigued

- Last night, my child slept a total of _____ hours

- My child sleep was disturbed by (please list any mental, emotional, physical or environmental factors that affected your child's sleep; e.g., stress, snoring, physical discomforts, temperature):

APPENDIX E:

Children Problem Behaviors Checklist

Client/Student's Name: _____ Therapist/Teacher's Name: _____

Date: _____ Time (starting & ending time): _____

Please mark the "frequency/duration" and "intensity" of problem behaviors your client/student shows today during your session, after comparing them to your impression of the client/student's behaviors usually show. Thank you!

Type of Behavior	**Frequency or Duration**			**Intensity**		
	Increased	No change	Decreased	Increased	No change	Decreased
Repetitive/ Stereotyped behaviors						
Aggression/ Destruction behaviors						
Self-injury behaviors						
Other?						

Note (any information regarding the problem behaviors can be recorded here):

_____
_____
_____

APPENDIX F:

Correlations of the Total and Subscale Score of CSHQ and PSQI (N = 49)

	PSQI	Sub 1	Sub 2	Sub 3	Sub 4	Sub 5	Sub 6	Sub 7	Sub 8	PSQI
CSHQ	0.466*									
Sub 1		1	0.468**	0.197	0.763**	0.264	-0.072	0.104	-0.237	0.201
Sub 2			1	0.503**	0.370**	0.126	-0.037	0.008	0.044	0.340*
Sub 3				1	-0.022	0.198	0.099	0.221	0.246	0.253
Sub 4					1	0.205	0.082	0.057	0.292*	0.176
Sub 5						1	0.325*	0.196	-0.066	0.237
Sub 6							1	0.250	0.189	0.274
Sub 7								1	0.022	0.145
Sub 8									1	0.242

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Note. Subscale 1: Bedtime Resistance (6 items); Subscale 2: Sleep Onset Delay (1 item); Subscale 3: Sleep Duration (3 items); Subscale 4: Sleep Anxiety (4 items); Subscale 5: Night Wakings (3 items); Subscale 6: Parasomnias (7 items); Subscale 7: Sleep Disordered Breathing (3 items); Subscale 8: Daytime Sleepiness (8 items).

APPENDIX G:

Correlations of the Total and Subscale Score of CSHQ and PSQI between Children with Sleep Problems and their Parents (Group 1), and between Those without Sleep Problems and their Parents (Group 2)

Group 1 (*n* = 29)

	Sub 1	Sub 2	Sub 3	Sub 4	Sub 5	Sub 6	Sub 7	Sub 8	CSHQ	PSQI
Sub 1	1	0.412*	0.226	0.693**	0.228	-0.270	0.022	-0.243	0.392*	0.338
Sub 2		1	0.533**	0.258	-0.460*	-0.279	0.081	0.021	0.295	0.309
Sub 3			1	-0.071	0.013	-0.082	0.380*	0.140	0.522**	0.138
Sub 4				1	0.269	0.008	-0.125	-0.371*	0.274	0.375*
Sub 5					1	0.172	0.106	-0.140	0.293	0.045
Sub 6						1	0.351	0.376*	0.528**	0.234
Sub 7							1	-0.023	0.403*	0.255
Sub 8								1	0.543**	0.197
CSHQ									1	0.504**
PSQI										1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Note. Subscale 1: Bedtime Resistance (6 items); Subscale 2: Sleep Onset Delay (1 item); Subscale 3: Sleep Duration (3 items); Subscale 4: Sleep Anxiety (4 items); Subscale 5: Night Wakings (3 items); Subscale 6: Parasomnias (7 items); Subscale 7: Sleep Disordered Breathing (3 items); Subscale 8: Daytime Sleepiness (8 items).

Group 2 (*n* = 20)

	Sub 1	Sub 2	Sub 3	Sub 4	Sub 5	Sub 6	Sub 7	Sub 8	CSHQ	PSQI
Sub 1	1	0.481*	-0.022	0.865**	0.113	0.169	0.276	-0.230	0.439	-0.157
Sub 2		1	0.212	0.528*	-0.132	0.235	-0.222	0.117	0.466*	0.176
Sub 3			1	-0.093	0.040	0.230	-0094	0.487*	0.573**	0.221
Sub 4				1	-0.167	0.137	0.091	-0.188	0.377	-0.284
Sub 5					1	0.384	0.676**	0.107	0.377	0.267
Sub 6						1	0.099	-0.110	0.369	0.136
Sub 7							1	0.097	0.400	-0.061
Sub 8								1	0.664**	0.358
CSHQ									1	0.226
PSQI										1

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Note. Subscale 1: Bedtime Resistance (6 items); Subscale 2: Sleep Onset Delay (1 item); Subscale 3: Sleep Duration (3 items); Subscale 4: Sleep Anxiety (4 items); Subscale 5: Night Wakings (3 items); Subscale 6: Parasomnias (7 items); Subscale 7: Sleep Disordered Breathing (3 items); Subscale 8: Daytime Sleepiness (8 items).

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